Project Manual

ST. CLOUD SCHOOL DISTRICT 742

APOLLO RENOVATIONS AND ADDITIONS BP2

Saint Cloud, Minnesota

CD Submittal

JLG architects

St. Cloud
505 W Saint Germain. #200
St. Cloud, MN 56301
p 320.408.7008

Project Number: JLG 19230.04

Date: April 10, 2026

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SECTION 00 0105 - CERTIFICATIONS PAGE

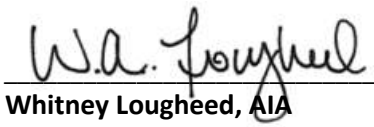
ISD 742 – ST. CLOUD AREA SCHOOL DISTRICT
APOLLO RENOVATIONS AND ADDITIONS BP2

ST. CLOUD, MINNESOTA

CERTIFICATIONS

Architect

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Architect under the laws of the State of Minnesota.



Whitney Lougheed, AIA **April 10, 2026**
Reg. No. 49185

Structural Engineer

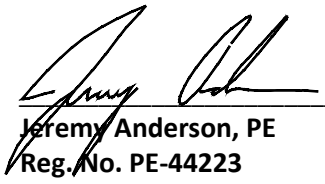
I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Eric Helminiak, PE **April 10, 2026**
Reg. No. PE-51810

Civil Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Jeremy Anderson, PE **April 10, 2026**
Reg. No. PE-44223

Mechanical Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Joseph Klinkhammer, PE **April 10, 2026**
Reg. No. PE-58285

Electrical Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Walter Wedan, PE **April 10, 2026**
Reg. No. PE-53194

END OF SECTION

SECTION 00 0110 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 00 -- Procurement and Contracting Requirements

00 0101 - Project Title Page
00 0105 - Certifications Page
00 0110 - Table of Contents
00 1113 - Advertisement for Bids
AIA Document A701 - 2018 - Instructions to Bidders
00 2213 - Supplementary Instructions to Bidders
00 2219 - Responsible Contractor Information
00 2413 - Contract Bid Categories
00 2600 - Procurement Substitution Procedures
00 3100 - Available Project Information
Geotechnical Report
00 4113 - Bid Form
00 5213 - Agreement Forms
AIA Document A132 - 2019 - Standard Form of Agreement Between Owner and Contractor
00 6100 - Bond Forms
00 6213 - Certificate of Insurance
00 6523 - Witholding Affidavit for Contractors
AIA Document A232 - 2019 - General Conditions of the Contract for Construction
00 7300 - Supplementary Conditions

SPECIFICATIONS

Division 01 -- General Requirements

01 1000 - Summary
01 1100 - Summary of Work
01 1216 - Work Schedule
01 2000 - Price and Payment Pro
01 2100 - Allowances
01 2300 - Alternates
01 2500 - Substitution Procedures
01 3000 - Administrative Requirements
01 3329 - Sustainable Design Requirements
01 4000 - Quality Requirements
Special Inspections and Testing Program
01 4533 - Code-Required Special Inspections and Procedures
01 4600 - Contractor Statement of Responsibility
01 6000 - Product Requirements
01 6116 - Volatile Organic Compound (VOC) Content Restrictions
01 7000 - Execution and Closeout Requirements
01 7419 - Construction Waste Management and Disposal
01 7800 - Closeout Submittals
01 9100.15 - Building Enclosure Commissioning Plan
01 9115 - Facility Building Enclosure Commissioning

Division 02 -- Existing Conditions

02 4100 - Demolition

Division 03 -- Concrete

03 0130.72 - Strengthening of Concrete with FRP (Fiber Reinforced Polymer) Reinforcement

03 1000 - Concrete Forming and Accessories

03 2000 - Concrete Reinforcing

03 3000 - Cast-in-Place Concrete

03 3511 - Concrete Floor Finishes

03 4100 - *Precast Structural Concrete - For Reference Only*

03 4500 - *Precast Architectural Concrete - For Reference Only*

Division 04 -- Masonry

04 2000 - Unit Masonry

04 2200 - Concrete Unit Masonry

Division 05 -- Metals

05 1200 - Structural Steel Framing

05 2100 - Steel Joist Framing

05 3100 - Steel Decking

05 4000 - Cold-Formed Metal Framing

05 5000 - Metal Fabrications

05 5133 - Metal Ladders

05 5305 - Metal Gratings and Floor Plates

05 7000 - Decorative Metal

Division 06 -- Wood, Plastics, and Composites

06 1000 - Rough Carpentry

06 4100 - Architectural Wood Casework

06 4200 - Wood Paneling

06 8316 - Fiberglass Reinforced Paneling

Division 07 -- Thermal and Moisture Protection

07 1900 - Water Repellents

07 2100 - Thermal Insulation

07 2119 - Foamed-In-Place Insulation

07 2600 - Vapor Retarders

07 4213.19 - Insulated Metal Wall Panels

07 4213.23 - Metal Composite Material Wall Panels

07 4243 - Composite Wall Panels

07 5100 - Built-Up Bituminous Roofing

07 6200 - Sheet Metal Flashing and Trim

07 7200 - Roof Accessories

07 8123 - Intumescent Fire Protection

07 8400 - Firestopping

07 9200 - Joint Sealants

07 9513 - Expansion Joint Cover Assemblies

Division 08 -- Openings

08 1113 - Hollow Metal Doors and Frames

08 1416 - Flush Wood Doors

08 1613 - Fiberglass Doors

08 1700 - Integrated Door Opening Assemblies
08 3100 - Access Doors and Panels
08 3313 - Coiling Counter Doors
08 3323 - Overhead Coiling Doors
08 3513.23 - Accordion Folding Fire Doors
08 3613 - Sectional Doors
08 4313 - Aluminum-Framed Storefronts
08 4413 - Glazed Aluminum Curtain Walls
08 4435 - Protective Framed Glazing Assemblies
08 7100 - Door Hardware
08 8000 - Glazing

Division 09 -- Finishes

09 2116 - Gypsum Board Assemblies
09 3000 - Tiling
09 5100 - Acoustical Ceilings
09 5426 - Suspended Wood Ceilings
09 6500 - Resilient Flooring
09 6566 - Resilient Athletic Flooring
09 6623 - Resinous Matrix Terrazzo Flooring
09 6700 - Fluid-Applied Flooring
09 6813 - Tile Carpeting
09 7200 - Wall Coverings
09 7800 - Interior Wall Paneling
09 8430 - Sound-Absorbing Wall and Ceiling Units
09 9113 - Exterior Painting
09 9123 - Interior Painting
09 9600 - High-Performance Coatings
09 9723 - Concrete and Masonry Coatings

Division 10 -- Specialties

10 1100 - Visual Display Units
10 1200 - Display Cases
10 1416 - Plaques
10 1419 - Dimensional Letter Signage
10 1423 - Panel Signage
10 1453 - Traffic Signage
10 2113.19 - Plastic Toilet Compartments
10 2123 - Cubicle Curtains and Track
10 2130 - PVC Strip Curtains
10 2600 - Wall and Door Protection
10 2800 - Toilet, Bath, and Laundry Accessories
10 4400 - Fire Protection Specialties
10 5617 - Wall Mounted Standards and Shelving
10 7500 - Flagpole
10 8211 - Architectural Coiled Wire Grilles and Screens - Cascade

Division 11 -- Equipment

11 4000 - Foodservice Equipment

Division 12 -- Furnishings
12 2400 - Window Shades
12 3553.13 - Metal Laboratory Casework
12 3553.19 - Plastic Laminate Laboratory Casework
12 3600 - Countertops
Division 21 -- Fire Suppression
21 0500 - Common Work Results for Fire Suppression
21 1313 - Wet-Pipe Sprinkler Systems
Division 22 -- Plumbing
22 0529 - Hangers & Supports for Plumbing Piping and Equipment
22 0553 - Identification for Plumbing Piping and Equipment
22 0700 - Plumbing Insulation
22 1100 - Facility Water Distribution
22 1300 - Facility Sanitary Sewerage
22 1400 - Facility Storm Drainage
22 3300 - Electric Domestic Water Heaters
22 4000 - Plumbing Fixtures
Division 23 -- Heating, Ventilating, and Air-Conditioning (HVAC)
23 0513 - Common Motor Requirements for HVAC Equipment
23 0516 - Expansion Fittings and Loops for HVAC Piping
23 0529 - Hangers and Supports for HVAC Piping and Equipment
23 0548 - Vibration & Seismic Controls for HVAC Piping and Equipment
23 0553 - Identification for HVAC Piping and Equipment
23 0593 - Testing, Adjusting, and Balancing for HVAC
23 0700 - HVAC Insulation
23 0800 - Commissioning of HVAC
23 0900 - Instrumentation and Control For HVAC
23 0923 - Direct-Digital Control System for HVAC
23 0993 - Sequence of Operations for HVAC Controls
23 1123 - Facility Natural-Gas Piping
23 2113 - Hydronic Piping
23 2116 - Hydronic Piping Specialties
23 2300 - Refrigerant Piping
23 2500 - HVAC Water Treatment
23 3100 - HVAC Ducts and Casings
23 3300 - Air Duct Accessories
23 3400 - HVAC Fans
23 3600 - Air Terminal Units
23 3700 - Air Outlets and Inlets
23 3813 - Commercial-Kitchen Hoods & Equipment
23 4000 - HVAC Air Purification Systems
23 7300 - Indoor Central-Station Air-Handling Units
23 7523 - Packaged Make-up Air Units
23 8216 - Air Coils
Division 26 -- Electrical
26 0500 - Common Work Results for Electrical

26 0510 - Selective Electrical Demolition
26 0519 - Conductors and Cables
26 0526 - Grounding and Bonding for Electrical Systems
26 0529 - Supporting Devices
26 0533 - Raceways, Fittings and Boxes
26 0800 - Testing and Commissioning of Electrical Systems
26 2213 - Transformers
26 2416 - Panelboards
26 2418 - Surge Protection Devices
26 2419 - Motor Control
26 2726 - Wiring Devices
26 2816 - Safety Switches
26 5100 - Lighting
26 5143 - Lighting Operations
26 5200 - Emergency Lighting

Division 27 -- Communications

27 0000 - General Technology Requirements
27 0500 - Communications General Requirements
27 0526 - Grounding and Bonding for Technology Systems
27 0528 - Pathways for Technology Systems
27 0537 - Firestopping for Technology Systems
27 1100 - Communications Equipment Rooms
27 1300 - Communications Backbone Cabling
27 1500 - Communications Horizontal Cabling
27 4000 - AV Multimedia General Requirements
27 4100 - Audio Visual Systems
27 5113 - Paging System
27 5313 - Synchronized Clock Systems
27 6000 - Physical Security General Requirements
27 6200 - Electronic Access Control System
27 6400 - Video Surveillance System
27 6600 - Intrusion Detection System

Division 28 -- Electronic Safety and Security

28 0500 - Common Work Results for Electronic Safety and Security
28 0515 - Testing of Fire Alarm Systems
28 3100 - Fire Alarm System

Division 31 -- Earthwork

31 0516 - Aggregates for Earthwork
31 1000 - Site Clearing
31 2000 - Earth Moving
31 2001 - Earth Moving Within Building Footprint
31 2200 - Grading
31 2333 - Trench Excavation and Backfilling for Utilities
31 2500 - Erosion and Sediment Controls

Division 32 -- Exterior Improvements

32 1123 - Aggregate Base Course

32 1216 - Asphalt Paving
32 1313 - Concrete Paving
32 1723 - Pavement Markings
32 5800 - Landscaping

Division 33 -- Utilities

33 1400 - Water Distribution Piping
33 3100 - Sanitary Sewerage Piping
33 3211 - Wastewater Pumping Stations
33 4200 - Stormwater Conveyance
33 4611 - Stormwater Management Systems

END OF SECTION

SECTION 00 1113 - ADVERTISEMENT FOR BIDS

PART 1 - GENERAL

1.1 PROJECT

A. Apollo Renovations and Additions BP2 – REBID #2
1000 44th Ave N
St. Cloud, MN 56303

1.2 OWNER

A. St. Cloud Area School District 742
1201 2nd Street South
Waite Park, MN 56387

1.3 PRE-BID MEETING

A. There will be a pre bid meeting Thursday October 15th at 10:00 AM. Please use the main entrance on the west side of the building for entry into the facility.

1.4 SEALED BIDS DUE

A. Thursday October 29th, 2026 no later than 2:00 PM local time.

1.5 PLACE DUE (SEALED BIDS)

A. SUBMIT BIDS IN SEALED ENVELOPE TO THE ATTENTION OF:

Amy Skaalerud at St. Cloud Area School District 742, located at 1201 2nd Street South – Waite Park, MN 56387.

B. Bids will be opened publicly and will need to be mailed or hand delivered in a sealed envelope.

C. Sealed bids with bid security are required for the following packages:
1. 7F Joint Sealants
2. 7G Firestopping

1.6 TYPE OF BIDDING, AND CLASSES OF WORK

A. Owner will accept sealed bids from Bidders for the prime contract per specification section 00 2413 Contract Bid Categories (Contracts to be awarded on a lump sum Basis).

B. See Section 00 2413 Contract Bid Categories for further description of individual contracts.

1.7 BIDDING DOCUMENTS

Plans and Specifications for submitting bids will be available for examination and distribution on or after October 7th, 2026. Documents may be reviewed at:

A. Electronic Documents will be available for download from Bradbury Stamm Construction smart bid web site. Please contact Ben Omann (bomann@bradburystamm.com) at Bradbury Stamm Construction to receive an invite.

1.8 BID SECURITY:

A. Required for all contracts. Submit certified check or acceptable Bidder's Bond payable to Owner in an amount equal to Five Percent (5%) of Total Base Bid, including alternates with each Bid per Instructions to Bidders.

1.9 RESPONSIBLE CONTRACTOR ACT:

A. Required for all contracts $50,000 and higher. Bidders are required to comply with the Minnesota Responsible Contractors Act (16C.285). Contractor's whose bid is greater than $50,000 are to include the verification of Compliance.

1.10 PERFORMANCE BOND

A. Performance Bond is required in the amount of 100 percent of Contract amount

B. Performance Bond is required in the amount of 100 percent of Contract amount.

1.11 PREVAILING WAGE

A. There are no prevailing wage requirements for this project

1.12 REJECTION

A. Owner reserves the right to reject any or all proposals and to waive Bidding formalities, and to award prime contracts to Bidder that Owner finds to their best advantage.

B. Each Bidder agrees to waive any claim it has or may have against Owner, Architect, Engineer, and their respective employees, arising out of or in connection with administration, evaluation, or recommendation of any Bid.

1.13 PRIOR APPROVAL

A. This Contract has a 7-calendar day prior approval clause for product Substitutions.

END OF SECTION

AIA® Document A701™ – 2018

Instructions to Bidders

for the following Project:
(Name, location, and detailed description)

Apollo Renovations and Additions BP2
1000 44th Ave N
St. Cloud, MN 56303

THE OWNER:
(Name, legal status, address, and other information)

Independent School District #742
1201 2nd Street South
Waite Park, MN 56387

THE ARCHITECT:
(Name, legal status, address, and other information)

JLG Architects
505 West Saint Germain Street – Suite 200
St. Cloud, MN 56301

TABLE OF ARTICLES

1 DEFINITIONS

2 BIDDER'S REPRESENTATIONS

3 BIDDING DOCUMENTS

4 BIDDING PROCEDURES

5 CONSIDERATION OF BIDS

6 POST-BID INFORMATION

7 PERFORMANCE BOND AND PAYMENT BOND

8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

Refer to 00 1113 Advertisement for Bid

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§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

Requests for clarification should be via email

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least seven (7) days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

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§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

Refer to 00 1113 Advertisement for Bid

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

Refer to 00 1113 Advertisement for Bid

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

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§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning60days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

Refer to 00 1113 Advertisement for Bid

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

Bid security will be retained by Construction Manager

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

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§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

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§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds
§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS
§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

N/A

.5 Drawings

Number	Title	Date

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.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages
TBD		

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

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SECTION 00 2213 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

Instructions to Bidders for Project consist of the following:

AIA Document A701, "Instructions to Bidders," a copy of which is bound in this Project Manual.
The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

PART 1 - DEFINITIONS

No modification or additions.

PART 2 - BIDDER'S REPRESENTATIONS

Add Section 2.1.3.1:

2.1.3.1 The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.

Add Section 2.1.5:

2.1.5 The Bidder is a properly licensed Contractor according to the laws and regulations of State of Minnesota and meets qualifications indicated in the Procurement and Contracting Documents.

Add Section 2.1.6:

2.1.6 The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

PART 3 - BIDDING DOCUMENTS

3.4 - Addenda:

Delete Section 3.4.3 and replace with the following:

Addenda may be issued up to three days prior to the receipt of bids, except to delay the bid opening.

Add Section 3.4.4.1:

3.4.4.1 Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:
3.4.4.1.1 - Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.
3.4.4.1.2 - Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

ARTICLE 4 - BIDDING PROCEDURES

4.1 - Preparation of Bids:

Add Section 4.1.1.1:

4.1.1.1 Printable electronic Bid Forms and related documents are available from the Construction Manager.

Add Section 4.1.8:

4.1.8 The Bid shall include unit prices when called for by the Procurement and Contracting Documents. Owner may elect to consider unit prices in the determination of award. Unit prices will be incorporated into the Contract.

Add Section 4.1.9:

4.1.9 Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

Add Section 4.1.10:

4.1.10 Bids shall include sales and use taxes. Contractors shall show separately with each monthly payment application the sales and use taxes paid by them and their subcontractors in the form indicated. Reimbursement of sales and use taxes, if any, shall be applied for by Owner for the sole benefit of Owner. Refer to the purchase agent agreement form for tax exempt items.

4.2 Bid Security:

Add Section 4.2.1.1:

4.2.1.1 No bid will be considered, unless it is accompanied by a certified check or acceptable Bid Bond payable without condition to the Owner in an amount equal to five percent (5%) of the total bid. The certified check or bid Bond, which must accompany each bid, is required as a guarantee that the bidder will furnish a performance and payment bond and certificates of insurance as specified after notice that contracts have been awarded and to him and are ready for execution.

Add Section 4.2.1.2:

4.2.1.2 The Bid Security of the three lowest bidders will be retained until the contract has been awarded and executed, but no longer that thirty (30) days. Other deposits will be returned within seven calendar days after the opening of the bids.

4.3 - Submission of Bids:

No Modifications or Additions to this section.

4.4 - Modification or Withdrawal of Bids:

Add the following sections to 4.4.2:

4.4.2.1 Such modifications to or withdrawal of a bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate bylaws, specifically empowered by the Bidder's charter or similar legally binding document acceptable to Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.

PART 5 - CONSIDERATION OF BIDS

5.2 - Rejection of Bids:

Add the following to 5.2:
Bid forms containing alterations, additions, deletions, or qualifications are subject to rejection.

Add Section 5.2.1:

5.2.1 Owner reserves the right to reject a bid based on Owner's and Architect's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

Add the following to 5.3.1:

Notice is hereby given that if two low bids are identical or if only one bid is received; the Owner reserves the right to negotiate such bids as provided by Law.

PART 6 - POSTBID INFORMATION

6.3 - Submittals:

Add Section 6.3.1.4:

6.3.1.4 Submit information requested in Sections 6.3.1.1, 6.3.1.2, and 6.3.1.3 no later than two business days following Architect's request.

PART 7 - PERFORMANCE BOND AND PAYMENT BOND

7.1 - Bond Requirements:

Add the following to paragraph 7.1.1:

The bonds stipulated by this paragraph shall be provided and paid for by the Contractor for the full amount of the contract.

Paragraph 7.1.1.1:

7.1.1.1 - Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum for any contract $175,000 and greater.

Add paragraph 7.1.4:
See General Conditions and Supplemental General Conditions for additional bond requirements.

PART 8 - FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

No modifications or additions.

PART 9 - EXECUTION OF THE CONTRACT

Add Article 9:

9.1.1 - Subsequent to the Notice of Intent to Award, and within 10 days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through Architect, in such number of counterparts as Owner may require.

9.1.2 - Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.

9.1.3 - Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement.

9.1.4 - In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

END OF SECTION

SECTION 002219 – RESPONSIBLE CONTRACTOR INFORMATION

PART 1 - GENERAL

1.1 PROJECT

Apollo Additions and Renovations BP2
1000 44th Ave N
St. Cloud, MN 56303

For all contracts exceeding $50,000 the Contractor must conform to the requirements of the "Responsible Contractor" law enacted by the State of Minnesota. Bidders are required to comply with the Minnesota Responsible Contractor's Act (16C.285). Contracts whose bid is greater the $50,000 are to include the verification of Compliance. A sample form is attached.

END OF SECTION

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RESPONSIBLE CONTRACTOR ACT – VERIFICATION OF COMPLIANCE

STATE OF MINNESOTA)

) ss.

COUNTY OF)

Project Name and Number: _____

I, _____ ,solemnly affirm under oath that I am an owner or officer of

_____ ("the Contractor") and state under oath that:

1. The Contractor meets all of the minimum criteria established in subdivision 3 of the Minnesota Responsible Contractor Law, Minnesota Statute section 16C.285; and any additional criteria that the contracting authority has included in the definition of responsible contractor in the bidding documents.

2. All subcontractors that the Contractor intends to retain have verified to the Contractor through a signed statement under oath by an owner or officer that they also meet the same minimum criteria, and that they have listed the subcontractors they intend to retain. Subject to the Contractor's right to add subcontractors, those subcontractors are:

   _____

   _____

   _____

   _____

3. I declare under penalty of perjury that, to the best of my knowledge, everything I have stated in this document is true.

By: _____

Title: _____

Subscribed and sworn to before me this day of 20 ____

_____

Notary Public

END OF SECTION

SECTION 00 2413 – CONTRACT BID CATEGORIES

PART 1 – GENERAL

1.01 DIVISION OF CONTRACT

A. This is a Construction Management Project. There is no General Contractor. The Owner will award separate contracts for all contracts described in this section. The Project will be administered, managed, and coordinated by the Construction Manager.

B. Although each Contract involves an obvious and recognizable segment of “conventional” subcontracting, multiple contract performance requires that adjustments be made to permit the completion of a contract as a construction unit. Each contractor is to review the total scope of their responsibilities with respect to their work and provide for the same in their proposal.

C. All work relative to the project is identified by the Contract Documents. Each contract is required to review all portions of the Contract Documents to completely determine their Scope of Work, and to become familiar with the scope of work of others. Nothing contained in the work scope description shall be constructed as overriding or changing the Contract Documents. Disputes concerning the assignment of work between prime contracts will be interpreted by the Construction Manager, and recommendations for resolution of the dispute provided to the Architect.

D. The Scope of each Contractor’s work is defined in this section. Each contractor shall familiarize themselves with the requirements of those contracts that interface with their own. The Contractor shall consider the fact that their work follows the work of another contractor and that still another contractor will interface with the work of their own.

E. Nothing contained in the contract documents and especially in the work scope shall be construed as a work assignment to any construction industry trade. Each Contractor is responsible for their own decision on work assignments and shall make then in accordance with the prevailing practice in the project, and in such a way that neither their progress not the progress of others shall be adversely affected by the Contractors decision.

F. There is no limit to the number of Contracts or combination of Contracts any one Contractor can bid. The Owner reserves the right to award individual contracts or any combination of contracts according to bids received.

G. The Owner may purchase certain material and equipment items to be incorporated into the work by designated Contractors. The designated Contractor is to accept delivery and unload, handle, store and install the appropriate items. Upon delivery, the designated Contractor is to verify product suitability, quantity, quality and condition as soon as it can be ascertained and shall accept care, custody and control responsibility as it were their own purchase.

H. The provisions of the General Conditions, Supplementary Conditions and Division 1 General Requirements apply to the work of each contract.

1.02 TRADE CONTRACT WORK SCOPES

A. Definitions

The following term used in the Contract Work Scope definitions are hereby defined as follows:

1. Supply: Contractor to provide Owner with specified item(s) for installation by others. All applicable taxes, freight charges, marking, protection and delivery to job site are the responsibility of the “Supply Only” contractor. Contractor to provide 48–hour advance notice on shipments to the job site. If 48-hour notice is not given, shipment may be refused by Construction Manager. Deliveries by ‘Supply Only’ contractors must be made to the job site at times to permit unloading by the installing contractor prior to the end of normal working hours. Overtime premiums required for unloading of materials after normal working hours shall be paid by the Supply Contractor.

2. Installation: contractor to unload, store, protect, sort, distribute and set/fix in place materials/items supplied by others as per the specifications and plans. All mounting hardware not part of the “Supply Only” contract is to be furnished by the installation contractor.

3. Provide: Contractor is responsible for the supply and installation of specified materials/items including delivery and unloading at the job site.

B. With the exception of the Supply Only contractors, **all contractors are responsible for the following eleven (11) scope items.**

1. Maintenance of safe working conditions for employees and others working in the vicinity; maintenance an ongoing safety program while on site. Contractor shall submit a comprehensive Safety Plan to the Construction Manager upon award of contract.

2. Temporary walls, Barricades and cover related to contractor work for maintenance of security, safety and cleanliness.

3. Ongoing clean-up of work area and removal of debris related to contractors work outside the construction limits indicated on the drawings.

4. Restoration of site locations disturbed by contractors work outside the construction limits indicated on the drawings.

5. Attendance at weekly site coordination meetings as scheduled by the Construction Manager during the duration of the contractor’s work on site.

6. Coordination with Owner and other contractors on site and the requirements of the construction schedule.

7. Mobilizations as required and scheduled by the Construction Manager.

8. Submittals, shop drawings and samples as specified.

9. All specified testing shall be by Owner. Costs of testing that fails and cost of retesting shall be paid by Contractor.

10. Layout work from Owner supplied benchmarks/grid lines.

11. Contractor is required to coordinate with Construction Manager and Owner for scheduling of work to maintain egress from the existing building through the construction work zone.

C. Work Scopes:
Separate proposals will be received for the following prime contracts:

2A Demolition, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)
02 4100 Demolition **As it applies to this package**

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Demolition may occur during normal business and school hours
4. Include shoring and shoring design. Include any additional mobilizations to remove shoring once no longer needed.
5. Floor protection to be carried as an allowance by the Construction Manager and will be scoped prior to each phase of construction. No allowance is to be carried by the
6. Dumpsters provided by Construction Manager
7. Refer to structural demolition and architectural demolition plans for full scope of demolition items. Contract package 31A is responsible for site demolitions including the canopy and piers at the Northwest corner of the building. Demolition contractor is responsible for all interior, exterior wall, and vestibule demolitions
8. Include all salvage and turn over to owner items as noted
9. Include demolition of parapet for flat concrete surface for new stud bearing wall per details 3 on S604 and 7 & 8 on S607.
10. Include all structural demolition foundation demo plan notes
11. Include all structural demolition roof framing demo plan notes
12. Include demolition of concrete slab for new footings. Refer to detail 10 on S103 for new footing in tunnel. Remove slab at these locations for footing limits
13. Refer to structural elevations for existing concrete beam openings. Include cutting openings at these locations. Refer to Addendum #2 keynote 9 for requirements.
14. Refer to architectural demolition plans for removal of floor slab, flooring, tiling, walls, columns, doors, exterior storefront assemblies, and ceilings.
    a. Refer to A121 for storefront and removal of wall assembly at locations in Area A1
15. Remove existing flooring and tile floor. Prepare subfloor as identified in demolition keynotes
16. Remove corridor lockers in Area A1.
17. Remove Choir Room and Band room risers
18. Removal and salvage of batting cages in Area 2 Room A303 by others
19. Removal and salvage of Pool A326 bleachers by others
20. Removal of all lockers and benches in Area A3 and Area A5 by others. Reference keynote 13 and 17 on architectural plans in Locker rooms. Support posts for benches to be removed by demolition contractor
21. Salvage existing athletic flooring in Locker rooms.
22. Demolish building portion A204F and A002 in its entirety. Include roof demolition, structural demolition, floor slab demolition, and all other demolition as required.
23. Include removal of overhead doors in C3 Area
24. Exterior pier and canopy assembly as noted on A115 removal is by Contract Package 31A
    a. Refer to keynote 9 on Civil removals page C201 for limits of pier and canopy removal by Contract Package 31A
25. Refer to A115 demo roof plan. Include removal of windows and metal panel keynotes. Refer to details on A524 for demolition requirements around Gymnasium roof. Refer to 2A, 4A, 6A, 8A, and 8C on A524 for additional demolition information.
26. Conex will be provided by Owner for salvaged material to be stored
27. Salvaging of existing ceiling tile to be reinstalled to be by Contract Package 9C Acoustical Ceilings
28. Demolition of Food Service equipment is by Contract Package 11A
29. Refer to floor plans for oversize cuts at masonry walls
30. Salvaging of existing doors to be salvaged for reinstallation is the responsibility of Contract Package 6A

3A Concrete, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

03 1000 Concrete Forming and Accessories
03 2000 Concrete Reinforcing
03 3000 Cast-in-Place Concrete
07 2100 Thermal Insulation **As applies to this package**
07 2600 Vapor Retarders **As applies to this package**
07 6200 Sheet Metal Flashing and Trim **As pertains to this package**
32 1313 Concrete Paving

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Contract package 3A will be required to complete the Contractor Statement of Responsibility as referenced in specification section 01 4600 in relation to the Multipurpose Space Storm Shelter
4. Review specifications section 01 2300 Alternates as an alternate affects this work scope. Provide pricing on the bid form for Alternates #1 and 2.
5. Include all curb / gutter, concrete sidewalks, concrete pavement, and concrete apron. Refer to A010 for colored concrete patterns and locations.
6. Include all ADA pedestrian ramps and reinstallation of salvaged truncated domes
7. Include all footings, foundations, and stoops for additions and vestibules. Contract Package 3A to set anchor bolts and precast wall assembly embed plates provided by others.
8. Include footings and foundations for precast benches and precast building signage.
9. Include interior slab on grade with reinforcement and vapor barriers as identified
    a. Contract package 22A is responsible for plumbing trenches outside of the defined concrete slab pour back locations
10. Include new footings for interior structural steel columns, masonry piers, and foundation walls
11. Include all concrete reinforcement. Include drill and epoxy of reinforcement as noted
12. Include all concrete columns and concrete beams as noted
13. Include concrete topping at double tee precast roof assembly
14. Include SMF-3 at exposed rigid insulation at foundation walls. Provide and install INSUL-1
15. Grout existing below grade masonry walls at locations where new concrete columns or slabs are constructed. Include reinforcement of existing masonry walls and cleaning / preparing walls for grout and reinforcement

3B Precast Fiber Reinforcement, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

03 0130.72 Strengthening of Concrete with FRP (Fiber Reinforced Polymer) Reinforcement

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Provide and install flexural reinforcing on bottom of precast planks. Refer to structural framing drawing for location
4. Provide and install flexural and shear RFP reinforcing at concrete beams as noted on structural drawings

3C Concrete Floor Finishes, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

003 3511 Concrete Floor Finishes

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Temporary power to provide by Contract Package 26A. Contract Package 3C to provide any whips for equipment to be used
4. Include CSLR-1 and PCONC-1. Review specifications for level of cut and sheen requirements
5. Include mock up for approval. Location to be determined by CM, mock up may remain as part of the work if approved.

4A Masonry, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

04 2000 Unit Masonry
04 2200 Concrete Unit Masonry
08 1113 Hollow Metal Doors and Frames – Install only **As pertains to this package**

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include installation of hollow metal frames within new masonry walls and at new masonry infills at existing walls.
4. Tooth in corners as needed in new CMU openings. Include minor demolition as needed for proper toothing.
5. Include new masonry piers as indicated. Refer to details for pier locations. Reference notes for pier locations as typical at openings. Include piers at both ends of openings as identified
6. Grout existing masonry walls at locations where new masonry piers are constructed. Include reinforcement of existing masonry walls and cleaning / preparing walls for grout
7. Include masonry infills as identified on project drawings
8. Patch and repair existing masonry walls as reference by keynote 25b and 25c on the floor plans. Grind mortar, remove wall ties, and correct mortar joints as needed. If additional soaping of new block is required that will be addressed as an additional cost.

5A Structural Steel – Material Only – TAX EXEMPT (NOT FOR BID – PREVIOUSLY AWARDED)

05 1200 Structural Steel Framing – Material Only
05 2100 Steel Joist Framing – Material Only
05 3100 Steel Decking – Material Only
05 5000 Metal Fabrications – Material Only
05 5133 Metal Ladders – Material Only
05 5305 Metal Gratings and Floor Plates – Material Only
05 7000 Decorative Metal – Material Only

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include delegated design with qualified professional engineer on structural steel connections indicated on drawings.
4. Include site visits for field verifications. Construction manager will facilitate lifts and equipment needed for field measuring. Structural steel provider to provide allocations for site visits for field verifications.
5. Steel fabricator to be AISC certified. Noncertified fabricator to reference 05 12000 1.6D for requirements to fabricate as non AISC certified. All costs for special inspections to be included for non AISC certified fabricators
6. Provide framing for all new, modified, or infill of roof openings
7. Include all steel base plates, columns, beams, joist, and deck as indicated
8. Provide all steel angle as identified
9. Provide all anchoring materials for steel assemblies
10. Refer to structural drawings for roof construction details. Include acoustic deck as noted as specified locations
11. Include all ladder systems including metal gratings as specified.
12. Include all steel guard railings as specified

5B Structural Steel – Installation Only (NOT FOR BID – PREVIOUSLY AWARDED)

05 1200 Structural Steel Framing – Installation Only
05 2100 Steel Joist Framing – Installation Only
05 3100 Steel Decking – Installation Only
05 5000 Metal Fabrications – Installation Only
05 5133 Metal Ladders – Installation Only
05 5305 Metal Gratings and Floor Plates – Installation Only
05 7000 Decorative Metal – Installation Only

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include all necessary lifts and hoisting equipment required for installation of structural metal components.
4. Include grouting of all base plates and top plates for all steel columns
5. Include relocation and installation of Capsule to main entry location. Refer to S608. Steel erector is to include necessary equipment for relocation
6. Include offload of all steel material supplied by Contract Package 5A.
7. Install roof support framing for all new, modified, or infilled roof locations
8. Install all steel columns, beams, joist, and deck
9. Install all steel angle as identified
10. Install all ladder systems, metal gratings, hand rails, and guard rails as noted

6A Carpentry, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

06 1000 Rough Carpentry – Material and Installation
06 4200 Wood Paneling – Material and Installation
06 8316 Fiberglass Reinforced Paneling – Material and Installation
08 1113 Hollow Metal Doors and Frames – Installation Only
08 1416 Flush Wood Doors – Installation Only
08 1613 Fiberglass Doors – Installation Only
08 3100 Access Doors and Panels – Material and Installation
08 7100 Door Hardware – Installation Only
09 7800 Interior Wall Paneling – Material and Installation
10 1100 Visual Display Units – Installation Only
10 2113.19 Plastic Toilet Compartments – Installation Only
10 2123 Cubicle Curtains and Track – Material and Installation
10 2130 PVC Strip Curtains – Material and Installation
10 2600 Wall and Door Protection – Installation Only
10 2800 Toilet, Bath, and Laundry Accessories – Installation Only
10 4400 Fire Protection Specialties – Installation Only

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Contract package 6A will be required to complete the Contractor Statement of Responsibility as referenced in specification section 01 4600 in relation to the Multipurpose Space Storm Shelter
4. Include all fasteners, tools, and equipment to complete scope of work.
5. Work scope will be responsible for acceptance, unloading, storage, and installation of material by others but installed in this package.
6. Include setting of hollow metal frames within p/c walls and existing walls. Hollow metal frames in new masonry and metal stud assemblies by others.
7. Include all backer in walls for wall mounted items/casework.
8. Reinstall salvaged plaque.
9. Include non-combustible z-clips behind WDP-2 at locations called out.
10. Include blocking, sheathing as specified for new openings.
11. Include installation of salvaged items including but not limited to fire extinguishers, doors, and hardware.
12. Remove and reinstall door thresholds as required for new flooring.
13. Reinstall existing fire extinguishers, fire cabinets, fire blankets, first aid kits, salvaged brackets and salvaged shelves.
14. Refer to finish plan RES PNL-1 for correct material ID for specification section 09 7800. Specification section material ID to be revised to RES PNL-1 in upcoming addendum
15. Provide hardware listed in 06 4200 Wood Paneling for the slotted wood paneling.
16. Reference RCP for CLG 2.4, 4.1, and 4.2 for addition WDP-1 and WDP-2 locations.
17. Provide non combustible z clips at WDP locations as indicated.
18. Provide and install ACC PNL-1 at Reception Counter (7D/A632)
19. Provide and install MT-8, MT-9, MT-10, MT-11, MT-12, and MT-13
20. Existing doors to be salvaged for reinstallation is the responsibility of Contract Package 6A. Contract Package 6A to remove existing doors and hardware and salvage for reuse as indicated.
21. Install Transom -1 as indicated

6B Casework, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

06 4100 Architectural Wood Casework
07 9200 Joint Sealants **As pertains to this package**
10 1200 Display Cases
10 5617 Wall Mounted Standards and Shelving
12 3600 Countertops

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Provide architectural wood casework, display cases, wall mounted standards and shelving, and countertops as specified.
4. Include site visits as needed for infield measurements and conditions.
5. Provide joint sealants from counter tops and casework to dissimilar materials and/or as specified.
6. Provide glass for display cases.
7. Include solid surface sills as noted
8. Include installation as required. Include off load of materials.
9. Include tote trays as noted

7A Water Repellent and Vapor Retarder (NOT FOR BID – PREVIOUSLY AWARDED)

07 1900 Water Repellent
07 2600 Vapor Retarders

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Provide and install water repellent at specified locations.
4. Include equipment as needed for safe, proper installation of water repellent.
5. Provide and install vapor retarder as specified. See specification for contractor's option.
6. Include but not limited to vapor retarder flashing over openings for a complete vapor retardant system at specified locations.
7. Cooperate with testing agency at vapor retard locations. Contractor to provide digital photographs of each portion of installation prior to covering up vapor retarder completed work
8. Refer to Addendum #2 for VPR RET-10 locations at door heads and jambs

7B Foamed In Place Insulation (NOT FOR BID – PREVIOUSLY AWARDED)

07 2119 Foamed-In-Place Insulation

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Furnish and install foamed-in-place insulation and intumescent coatings as specified.

7C Roofing, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

06 1000 Rough Carpentry **As pertains to this package**
07 5100 Built-Up Bituminous Roofing
07 6200 Sheet Metal Flashing and Trim
07 7200 Roof Accessories

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include flashing in and roof patchwork to new equipment on existing roofs. Install new crickets and/or cants to provide proper drainage as required.
    a. Existing roofs to be patched or modified are a Garland roof, see roof assembly R5 on G102.
4. Provide all sheet metal flashing at roof copings on new and existing roofs as detailed.
5. Provide scuppers, pipe flashings, and other roofing elements.
6. Include all rough carpentry for all roof related items. Ie. roof coping, scuppers, overflows, parapets, and jambs.
7. Provide pipe box curbs. Coordinate with CM and 22A for pipe openings.
8. Include demo, added insulation, roof patching as required for proper drainage to new scuppers as shown on roof plans.
9. Refer to project plans for all roof insulation requirements
10. Include demolition of roofing for new wall framing around existing Gymnasium. Refer to A524 and A525.
11. Refer to mechanical and electrical drawings for new roof penetrations and existing penetrations to be capped.
12. Install food service curbs for condensing unit. Curb supplied by Food Service contractor.
13. Include RF Hatch-1 and RF Hatch-2

7D Metal Wall Panels, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

07 2100 Thermal Insulation **As pertains to this package**
07 4213.19 Insulated Metal Wall Panels
07 4213.23 Metal Composite Material Wall Panels
07 4243 Composite Wall Panels
09 2116 Gypsum Board Assemblies **As pertains to this package**

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Furnish and install wall panels as specified.
4. Furnish and install material type INSUL – 26. FUR– 5 at X7 wall types, and 1-1/2” deep panel stiffeners per metal panel recommendations.
5. Provide concealed hanging clips and wall furring by manufacture for COMP PNL-20

7F Joint Sealants and Expansion Joint Cover Assemblies, Complete – Material & Installation

07 2100 Thermal Insulation **As it pertains to this package**
07 9200 Joint Sealants
07 9513 Expansion Joint Cover Assemblies

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Provide joint sealants and expansion joint cover assemblies as specified.
4. Include reinstall of salvaged expansion joint covers as specified.
5. Precast wall contractor is responsible for joint sealants for precast wall and plank assemblies
6. Casework contractor is responsible for joint sealants from countertops and casework to dissimilar materials and or as specified
7. Storefront and curtainwall contractor is responsible for joint sealants at these applicable openings.

7G Firestopping, Complete – Material & Installation

07 8400 Firestopping

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Provide firestopping assemblies as specified.
4. Mechanical, Electrical, Plumbing, and Fire Suppression contractor are responsible for their respective fire stopping at their penetrations.
5. Provide mineral wool to stuff and seal around existing penetrations to comply with smoke resistant construction. See RCP for areas of work.
6. Furnish and install FR Stop as indicated.

8A Doors, Frames, and Hardware – Material Only – TAX EXEMPT (NOT FOR BID – PREVIOUSLY AWARDED)

07 6200 Sheet Metal Flashing and Trim **As pertains to this package**
08 1113 Hollow Metal Doors and Frames – Material only
08 1416 Flush Wood Doors – Material only
08 1613 Fiberglass Doors – Material only
08 7100 Door Hardware – Material only **As pertains to this package**

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
    a. Multiple deliveries will be required.
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.

3. Contract package 8A will be required to complete the Contractor Statement of Responsibility as referenced in specification section 01 4600 in relation to the Multipurpose Space Storm Shelter
4. Include all material FOB to jobsite. Coordinate with CM for deliveries.
5. Exclude hardware for aluminum entrances and interior aluminum doors. Provide door hardware for wood doors within an aluminum storefront, hollow metal frame, and for fiberglass doors.
6. ~~Keying scope to be modified by a future addendum~~.
7. Provide Transom -1 as indicated

8B Integrated Door Opening Assemblies, Complete – Material and Installation (NOT FOR BID – PREVIOUSLY AWARDED)

08 1700 Integrated Door Opening Assemblies
08 7100 Door Hardware – Material only **As pertains to this package**

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Furnish and install hardware pertaining only to the integrated door opening assemblies.

8C Storefront Systems, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

08 4313 Aluminum-Framed Storefronts
08 4413 Glazed Aluminum Curtain Walls
08 4435 Protective Framed Glazing Assemblies
08 7100 Door Hardware **As pertains to this package**
08 8000 Glazing

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Contract package 8C will be required to complete the Contractor Statement of Responsibility as referenced in specification section 01 4600 in relation to the Multipurpose Space Storm Shelter
4. Provide door hardware for aluminum entrances.
5. Reinstall salvaged storefront as specified.
6. Include flashing at head, jambs, and sills for storefront or curtain wall openings.
7. Refer to project documents for all fire rated glazing and assembly requirements
8. Include FILM-1 as identified
9. Include delegated design for curtain wall ALCRTN-4 as indicated on G101
10. Specification Section 13 3424 Specialty Glazed Façade Structure added in Addendum #4 will be by add Contract Package 8F. ALCRTN-4 by others

8D Overhead and Coiling Doors, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

08 3313 Coiling Counter Doors
08 3323 Overhead Coiling Doors
08 3613 Sectional Doors
10 8211 Architectural Coiled Wire Grilles and Screens – Cascade

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Contract package 8D will be required to complete the Contractor Statement of Responsibility as referenced in specification section 01 4600 in relation to the Multipurpose Space Storm Shelter
4. Furnish and install coiling counter doors, overhead coiling doors, and sectional doors as specified.
5. Include delegated design with qualified professional engineer for the Draper Coil tagged MD-1.
6. Include necessary site visits for in field conditions and dimensions of openings.

8E Accordion Folding Fire Doors, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

08 3513.23 Accordion Folding Fire Doors

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Furnish and install accordion folding fire doors as specified.
4. Include threaded rod, nuts, clips, etc. for mounting accordion folding fire door assembly to structural beam.

8F Specialty Glazed Façade Structure – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

13 3424 Specialty Glazed Façade Structure

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Provide and install ALCRTN-4. Provide design requirements as indicated

9A Drywall, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

05 4000 Cold Formed Metal Framing
07 2100 Thermal Insulation **As pertains to this package**
08 1113 Hollow Metal Doors and Frames – Install only **As pertains to this package**
09 2116 Gypsum Board Assemblies

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include delegated design with qualified professional engineer for cold formed metal framing.
4. Include installation of hollow metal frames within new steel stud walls.
5. Include all temporary partitions and removal per phasing plans. Temporary partition is to be (1) layer of 5/8" type X gyp board each side with 3 5/8" metal stud.
6. Infill, patch, and repair existing walls where removal abutted to as required and referenced by keynote 25A on the floor plans
7. Exclude FR Stop, by 7F work scope.
8. Contractor to provide rated wall assemblies as indicated, provide submittals as required by AHJ.
9. Provide CEM BD-2 at walls as referenced on partition assemblies G102. Include CEM BD-2 at locations as noted on floor plan keynotes.
10. Provide and install Fur-1. Fur-5 by contract package 7D
11. Provide and install Gyp ACC-1 Cyclorama Wall Components
12. Provide and install Gyp-SHTG-2 as identified
13. Provide and install Insul-26 at X6 wall assemblies
14. Provide and install Insul-80 and Insul-81
15. Provide and install MT-14

9B Tiling, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

09 3000 Tiling

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include tile sealant between tile and plumbing fixtures.
4. Include waterproofing membrane at walls, ceiling, and floors at shower locations. Refer to project specifications and drawings for referenced locations.
5. Provide and install MT-1, MT-2, MT-3, and MT-7

9C Acoustical Ceilings, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

09 5100 Acoustical Ceilings
09 5426 Suspended Wood Ceilings
09 8430 Sound-Absorbing Wall and Ceiling Units

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include reinstalling all ACT as noted.
4. Salvaging of existing ceiling tile to be reinstalled to be by Contract Package 9C Acoustical Ceilings

9D Flooring, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

09 6500 Resilient Flooring
09 6566 Resilient Athletic Flooring
09 6813 Tile Carpeting

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Review specifications section 01 2300 Alternates as an alternate affects this work scope. Provide pricing and submit on the bid form for Alternate 03.
4. Provide and install resilient flooring, resilient athletic flooring, tile carpeting, and resilient base as specified.
5. Include court markings on resilient athletic flooring at room A237 per A205.
6. Include floor prep from carpet flooring to existing terrazzo tile as noted on finish plans. Include floor prep at carpet locations where carpet and new terrazzo align.
7. Install salvaged rubber athletic flooring as indicated
8. Provide and install MT-6

9E Terrazzo Flooring, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

09 6623 Resinous Matrix Terrazzo Flooring

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Provide and install resinous matrix terrazzo flooring as specified. Include terrazzo base as identified
4. Apply floor prep to match floor finish height with existing terrazzo logo flooring, existing terrazzo tiling, and existing wood flooring. Refer to finish plans for reference of required heights and scope of floor prep.
5. Include floor prep to Gym Door 2 per 6E/A233
6. Provide and install MT-4

9F Fluid-Applied Flooring, Complete – Material & Installation(NOT FOR BID – PREVIOUSLY AWARDED)

09 6700 Fluid-Applied Flooring

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Provide and install fluid applied flooring and integral cove base as specified.
4. Include mock ups as specified in specification section 09 6700 – 1.05 A.
5. Provide and install necessary floor preparation for installation of fluid applied flooring assemblies, including at plumbing drain locations
6. Provide and install MT-5 for transition to fluid applied flooring

9H Painting, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

07 8123 Intumescent Fire Protection
09 7200 Wall Coverings
09 9113 Exterior Painting
09 9123 Interior Painting
09 9600 High-Performance Coatings

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include painted lettering for Fire and/or Smoke Barriers as required and shown on A637.
4. ~~Include prime and paint of soil stacks and associated metal flashing at roof penetrations.~~ OMIT
5. Where existing doors and frames are to be repainted, this work scope to include removal of all existing paint on door hardware.
6. Include skim coating edge of concrete and paint.
7. Include painting or repainting of hollow metal doors and frames as specified.
8. Include repainting of existing louvers. Louvers to be cleaned by this work scope prior to painting.
9. Include the following items for the existing capsule
    a. Cleaning and painting capsule white
    b. Bondo existing dents that will be exposed through ceiling prior to painting. Extents to be reviewed in field with architect, owner, and CM.
    c. Provide (3) 2'x2' vinyl decals to be adhered to capsule.
10. Paint the overhead doors frames at A203.1 - dish return, A204.2 – dishwashing, A237A, to match wall.
11. Paint the coiling storm jamb angle metal and flashing to match wall.
12. Paint the glass black on opening A236.2
13. Paint expansion joint assemblies as noted.
14. Paint underside of concrete canopies in lieu of concrete staining. See reflected ceiling plans.
15. Paint guard rail as noted.
16. Paint all exposed steel, plates, mounting brackets at railings, wood sheeting, etc. as noted.
17. Paint new overflow scuppers at existing parapets.
18. Paint wiremolds at coiling fire doors.
19. Where ceilings are indicated to be painted, paint all exposed construction including but not limited to mechanical and electrical items.

20. Refer to specification section 01 2100. Include $3,000 allowance as specified.
21. Refer to FR PRF-20 for Intumescent Fire Protection designation and locations

9I Concrete and Masonry Coatings, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

09 9723 Concrete and Masonry Coatings

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Work scope to include concrete and masonry coatings as specified.
4. Include interior brick staining as noted on finish plans.

10A.1 Visual Display Units – Material Only – TAX EXEMPT (NOT FOR BID – PREVIOUSLY AWARDED)

10 1100 Visual Display Units – Material Only

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
    a. Include as many deliveries as needed per phasing plan
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Include all material FOB to jobsite. Coordinate with CM for deliveries.
4. Include all marker boards and tack boards as noted. Include all accessories such as map rail, marker tray, magnets, etc. per the specification

10A.2 Plastic Toilet Compartments – Material Only – TAX EXEMPT (NOT FOR BID – PREVIOUSLY AWARDED)

10 2113.19 Plastic Toilet Compartments – Material Only

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
    a. Include as many deliveries as needed per phasing plan
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Include all material FOB to jobsite. Coordinate with CM for deliveries.
4. Include solid plastic toilet compartments as noted in the specifications and drawings

10A.3 Wall and Door Protection – Material Only – TAX EXEMPT (NOT FOR BID – PREVIOUSLY AWARDED)

10 2600 Wall and Door Protection – Material Only

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
    a. Include as many deliveries as needed per phasing plan
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Include all material FOB to jobsite. Coordinate with CM for deliveries.
4. Include corner guards as noted

10A.4 Toilet, Bath, and Laundry Accessories – Material Only – TAX EXEMPT (NOT FOR BID – PREVIOUSLY AWARDED)

10 2800 Toilet, Bath, and Laundry Accessories – Material Only

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
    a. Include as many deliveries as needed per phasing plan
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Include all material FOB to jobsite. Coordinate with CM for deliveries.
4. Include mirrors, grab bars, sanitary napkin disposal, coat hooks, shower curtain rod, shower curtain, folding shower seat, changing stations, and combination utility shelf / mop and broom holder.

10A.5 Fire Protection Specialties – Material Only – TAX EXEMPT (NOT FOR BID – PREVIOUSLY AWARDED)

10 4400 Fire Protection Specialties – Material Only

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
    a. Include as many deliveries as needed per phasing plan
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Include all material FOB to jobsite. Coordinate with CM for deliveries.
4. Include fire extinguishers, cabinets, and brackets as noted

10B Signage, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

10 1416 Plaques
10 1419 Dimensional Letter Signage
10 1423 Panel Signage

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Review specifications section 01 2300 Alternates as an alternate affects this work scope. Provide pricing on the bid form for Alternates #1 and #2.
4. Provide plaques as indicated.
5. Provide dimensional letter signage as indicated.
6. Provide panel signage as indicated.
7. Include all equipment, tools, and hardware for a complete install of plaques, dimensional letter signage, and panel signage.

10C Flagpole, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

10 7500 Flagpole

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Provide and install new flagpole. Include flagpole base and concrete as required

11A Food Service, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

02 4100 Demolition **As it applies to this package (refence scope notes)**
11 4000 Foodservice Equipment

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Refer to general demolition notes for reused / relocated equipment. Food service contractor is responsible to take inventory of existing equipment. Food service contractor to remove items and secure for safe storage
4. Remove and dispose of non reused items as noted. Food service contractor is responsible for recycling of non reused equipment. Include reclamation of refrigeration systems.
5. Include supply and install of all Food Service equipment as indicated in the project drawings and specifications.

12A Window Treatments, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)
12 2400 Window Shades

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Provide window shades as specified.

12B Laboratory Casework, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)
12 3553.13 Metal Laboratory Casework
12 3553.19 Plastic Laminate Laboratory Casework

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Provide metal and plastic laminate laboratory casework as specified.
4. Include all installation including offloading material into jobsite

21A Fire Suppression, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

02 4100 Demolition **As pertains to this package**
07 8400 Firestopping **As pertains to this package**
21 0500 Common Work Results for Fire Suppression
21 1313 Wet-Pipe Sprinkler Systems

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Contract package 22A will be required to complete the Contractor Statement of Responsibility as referenced in specification section 01 4600 in relation to the Multipurpose Space Storm Shelter
4. Fire protection penetration of storm shelter must be protected per ICC-500 requirements.
5. Include any temporary measures for fire suppression systems.
6. Fire protection contractor is responsible to provide firestopping at all fire protection piping penetrations at rated assemblies.
7. Include all fire suppression demolition as required.
8. Include fire suppression as required at all kitchen exhaust hoods.
9. Fire suppression contractor to pay and procure any permits required for this contract package.
10. Submit design calculations with shop drawings for review and approval.
11. Disconnection of food service equipment is the responsibility of this work scope for their discipline.
12. Refer to food service equipment and specifications for fire suppression requirements.
13. Refer to Addendum #2 for relocated fire suppression main requirements

22A Mechanical, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

02 4100	**Demolition **As pertains to this package****
07 8400	**Firestopping **As pertains to this package****
07 9200	**Joint Sealants **As pertains to this package****
22 0529	**Hangers & Supports for Plumbing Piping and Equipment**
22 0553	**Identification for Plumbing Piping and Equipment**
22 0700	**Plumbing Insulation**
22 1100	**Facility Water Distribution**
22 1300	**Facility Sanitary Sewerage**
22 1400	**Facility Storm Drainage**
22 1500	**General Service Compressed Air Systems**
22 3300	**Electric Domestic Water Heaters**
22 4000	**Plumbing Fixtures**
23 0513	**Common Motor Requirements for HVAC Equipment**
23 0516	**Expansion Fittings and Loops for HVAC Piping**
23 0529	**Hangers and Supports for HVAC Piping and Equipment**
23 0548	**Vibration & Seismic Controls for HVAC Piping and Equipment**
23 0553	**Identification for HVAC Piping and Equipment**
23 0593	**Testing, Adjusting, and Balancing for HVAC**
23 0700	**HVAC Insulation**
23 0800	**Commissioning of HVAC**
23 0900	**Instrumentation and Control for HVAC**
23 0923	**Direct-Digital Control System for HVAC**
23 0993	**Sequence of Operations for HVAC Controls**
23 1123	**Facility Natural-Gas Piping**
23 2113	**Hydronic Piping**
23 2116	**Hydronic Piping Specialties**
23 2300	**Refrigerant Piping**
23 2500	**HVAC Water Treatment**
23 3100	**HVAC Ducts and Casings**
23 3300	**Air Duct Accessories**
23 3400	**HVAC Fans**
23 3600	**Air Terminal Units**
23 3700	**Air Outlets and Inlets**
23 3813	**Commercial – Kitchen Hoods & Equipment**
23 4000	**HVAC Air Purification Systems**
23 7300	**Indoor Central-Station Air-Handling Units**
23 7523	**Packaged Make-Up Air Units**
23 8216	**Air Coils**

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Contract package 22A will be required to complete the Contractor Statement of Responsibility as referenced in specification section 01 4600 in relation to the Multipurpose Space Storm Shelter
4. Include all lifts, equipment, and hoisting measures required to complete this scope of work
5. Any items identified to be salvaged for reuse are to be stored in a neat and organized location as directed by the Construction Manager
6. Mechanical engineer will submit the plumbing plans to the State of MN for plan review. Mechanical contractor is responsible for payment and obtaining the permit after plan review.

7. School District will contract direct for commissioning. Mechanical contractor is required to coordinate as noted within Commissioning of HVAC specifications
8. Mechanical contractor responsible for all mechanical demolition as required.
9. Mechanical contractor is responsible to provide firestopping at all hydronic / water piping and duct penetrations at rated assemblies.
10. Concrete floor slab removal required for plumbing trenching is the responsible of Contract Package 22A. Include pour back of trenches with reinforcement as shown on structural typical slab on grade patch detail. Refer to architectural demolition for limits of concrete slab removal and pour back by Contract Package 2A and Contract Package 3A. Plumbing trenching required outside of these limits is the responsibility of Contract Package 22A
11. Disconnect and remove all plumbing fixtures, plumbing piping, mechanical equipment, mechanical piping, and connections as indicated
12. Above ceiling new piping runs in ceilings that are not being removed is the responsibility of the Mechanical contractor to work through. Mechanical contractor to remove and replace ceilings tiles as needed for their scope of work
13. Refer to the plumbing plans for reference to requirements for the acid neutralization tank and venting. Provide and install this system in its entirety.
14. Provide and install grease interceptors as identified. Contract package 22A is responsible for excavation and backfill of grease interceptor. Remove and dispose of any additional soils not used for backfilling
15. Mechanical contractor to provide all plumbing and mechanical connections to food service equipment.
16. Provide and install all plumbing fixtures.
17. Install splash blocks at storm overflows at exterior of building
18. Mechanical contractor is responsible to cap and abandon existing underfloor ductwork as identified
19. Include all natural gas piping and connections as indicated
20. Provide duct cleaning as indicated.
21. Include housekeeping pads as noted for new or relocated equipment
22. Provide and install smoke vents
23. Include building controls within this package. Refer to 23 0923 for approved manufacturers. No substitutions will be granted.
24. Include 6” long hardwood blocking under RTU curbs at joists per 10/S602. Coordinate with structural and mechanical plans for locations.
25. Include kitchen exhaust hoods as specified
26. Disconnection of food service equipment is the responsibility of this work scope for their discipline.
27. Demolish existing in floor hydronic heating as noted in Addendum #2. Refer to slab removal locations, disconnect and prepare for demolition of slab.

26A Electrical, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

02 4100	**Demolition **As pertains to this package****
07 8400	**Firestopping **As pertains to this package****
26 0500	**Common Work Results for Electrical**
26 0510	**Selective Electrical Demolition**
26 0519	**Conductors and Cables**
26 0526	**Grounding and Bonding for Electrical Systems**
26 0529	**Supporting Devices**
26 0533	**Raceways, Fittings, and Boxes**
26 0800	**Testing and Commissioning of Electrical Systems**
26 2213	**Transformers**
26 2416	**Panelboards**
26 2418	**Surge Protection Devices**
26 2419	**Motor Control**
26 2726	**Wiring Devices**
26 2816	**Safety Switches**
26 5100	**Lighting**
26 5143	**Lighting Operations**
26 5200	**Emergency Lighting**
27 0000	**General Technology Requirements**
27 0500	**Communications General Requirements**
27 0526	**Grounding and Bonding for Technology Systems**
27 0528	**Pathways for Technology Systems**
27 0537	**Firestopping for Technology Systems**
27 1100	**Communications Equipment Rooms**
27 1500	**Communications Backbone Cabling**
27 4000	**AV Multimedia General Requirements**
27 4100	**Audio Visual Systems**
27 5113	**Paging System**
27 5313	**Synchronized Clock Systems**
27 6000	**Physical Security General Requirements**
27 6200	**Electronic Access Control System**
27 6400	**Video Surveillance System**
27 6600	**Intrusion Detection System**
28 0500	**Common Work Results for Electronic Safety and Security**
28 0515	**Testing of Fire Alarm Systems**
28 3100	**Fire Alarm System**

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Review specifications section 01 2300 Alternates as an alternate affects this work scope. Provide pricing on the bid form for Alternates #1 and 2.
4. Contract package 26A will be required to complete the Contractor Statement of Responsibility as referenced in specification section 01 4600 in relation to the Multipurpose Space Storm Shelter
5. Refer to specification section 26 0800 Testing and Commissioning of Electrical Systems. Electrical contractor to provide 3rd party commissioning agent under this contract.
6. Electrical contractor to pay and procure any permits required for this contract package
7. Electrical contractor is responsible for all electrical demolition as required.
8. Electrical contractor is responsible to provide firestopping at all cabling and conduit penetrations at rated assemblies.

9. Electrical contractor to provide temporary power and temporary lighting as required for renovation and addition areas.
    a. Include temporary power for polished concrete and epoxy flooring grinders. Whips provided by others
10. Disconnect and remove light pole as shown on civil removal plans
11. Electrical contractor is responsible for all electrical disconnects of equipment to be removed. Include all disconnects of in wall electrical for architectural and structural demolitions
12. Include demolition of all lighting and lighting controls as specified. Salvage required lighting fixtures and lighting controls as indicated
13. Refer to electrical demolition general notes for ceiling mounted devices. Electrical contractor is responsible to temporary relocation or handing from building structure for devices to remain
14. Provide electrical for sanitary grinder station
15. Provide and install all new lighting and lighting controls as identified
16. Secure and assist the Owner with any lighting rebate programs available.
17. Provide and install voice fire alarm mass notification system throughout entire building
18. Provide and install lighting inverter per specifications to meet storm shelter requirements
19. Provide power as indicated to roof mounted mechanical equipment
20. Electrical contractor to provide and install lighting poles bases
21. Wiring and conduit run in ceilings that are not being removed is the responsibility of the electrical contractor to work through. Electrical contractor to remove and replace ceilings tiles as needed for their scope of work
22. Refer to mechanical drawing M302. Electrical contractor to relocate boiler emergency stop switch to new location shown on mechanical plans. Provide tamper proof cover
23. Electrical contractor is responsible for all technology demolition, relocations, and salvaging of existing devices as indicated on technology drawings.
24. Electrical contractor is responsible for all technology, communications, audio / visual control and equipment, paging systems, synchronized clock systems, security, access control, intrusion detection, and fire alarm system. Include a complete system as identified including pathways, cabling, boxes, devices, and equipment as noted.
25. Refer to door hardware specification for hardware schedule. Include material and install of all door hardware identified to be by fire alarm contractor and security supplier
26. Include painting of luminaire wires orange.
27. Electrical contractor to provide all electrical connections to food service equipment.
28. Disconnection of food service equipment is the responsibility of this work scope for their discipline.

31A Earthwork & Utilities, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

31 0516 Aggregates for Earthwork
31 1000 Site Clearing
31 2000 Earth Moving
31 2001 Earth Moving Within Building Footprint
31 2200 Grading
31 2500 Erosion and Sediment Controls
31 2333 Trench Excavation and Backfilling for Utilities
32 1123 Aggregate base Course
33 1400 Water Distribution Piping
33 3100 Sanitary Sewerage Piping
33 3211 Wastewater Pumping Stations
33 4200 Stormwater Conveyance
33 4611 Stormwater Management Systems

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Include complete bid via the sealed bid process including completed bid form and bid security. Include payment and performance bond as required per the project documents.
3. Include all erosion control measures including silt fencing, storm drain inlet protections, concrete washout, and construction entrance. Erosion control measures shall include all SWPPP monitoring and reporting
    a. Include temporary seeding as required for SWPPP. Final seeding will be done by Contract Package 32C
4. Review specifications section 01 2300 Alternates as an alternate affects this work scope. Provide pricing on the bid form for Alternates #1 and 2.
    a. Civil drawings currently do not show the additional way finding signage. See future addendum.
5. Refer to geo technical report in the project specifications for the assumed conditions of the soils. Earthwork contractor is responsible to import and export all material required. Reference structural drawings for fill requirements a Storm Shelter. Include shoring of existing wall at soil correction area. Addendum #3 to formally to allowance for the cubic amount of soil correction to be figured.
6. Contract package 31A is responsible for obtaining and payment of the NPDES permit.
7. Contract package 31A is responsible for removal and disposal of all materials identified in this work scope
8. Saw cut existing bituminous pavement, concrete pavement, and curb / gutter as identified
9. Remove existing bituminous pavement, concrete pavement, curb / gutter, retaining walls, bollards hardscapes, stoops, and flag poles as identified
10. Remove existing foundations and concrete slab at existing building (Keynote 7 on C201)
11. Remove concrete pillars and canopy at Northwest corner of existing facility. Refer to keynote 9 on C201
12. Remove storm piping, sanitary piping, and storm structures as identified
13. Salvage truncated domes as shown
14. Remove and dispose of trees as shown
15. Relocate hydrant line
16. Vestibule demolition and exterior building wall demolition is by Contract Package 2A
17. Relocate site sign (refer to keynote 10 on C202)
18. Provide grading and aggregate base as required for curb / gutter, bituminous pavement, bituminous paths, concrete sidewalks, concrete pavement and concrete apron
19. Include excavation for all stoops, footings, foundations, and monument sign. Include backfill of these items

20. Include site utilities including but not limited to new water line piping, sanitary piping, and storm piping.
21. Provide all utility connections as shown including but not limited to existing piping connection and existing catch basins / structures.
22. Provide and install sanitary grinder stations
23. Include underground infiltration system near Storm Shelter
24. Excavation for grease interceptors is by contract package 22A
25. Include compacted granular fill at interior building locations as required
    a. Set Storage and Scene Shop A109
    b. Collaboration B409
    c. Collaboration B608
26. Include interior excavation and backfill of new footings and foundations.
27. Include removal and salvaging of granite seats and benches as shown on architectural demolition plans. Relocate as shown on A010.
28. Remove all concrete pavement, trees, shrubs, and plantings in Courtyard A421. Prep area for new floor slab construction including aggregate base
29. Refer to specification section 01 2100 Allowances. Include in bid the allowance specified for grading and excavation requirements for soil corrections at the Storm Shelter.
30. Refer to specification section 01 2200 Unit Prices. Provide unit pricing for Unit Price 1 and Unit Price 2.

32A Asphalt Paving, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

10 1453 Traffic Signage
32 1216 Asphalt Paving
32 1723 Pavement Markings

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Install new bituminous pavement and bituminous paths.
4. Include parking lot striping as identified
5. Include supply and install of traffic signage as shown

32C Landscaping, Complete – Material & Installation (NOT FOR BID – PREVIOUSLY AWARDED)

32 5800 Landscaping

Scope Notes:

1. Review specification section 01 1216 Work Schedule and project drawings G131 through G136 for project phasing plans. Contractors are to include all costs for mobilizations required for each phase
2. Review specification section 00 1113 Advertisement for bid. Quotes will be received by Bradbury Stamm Construction. Email quotes to bomann@bradburystamm.com
3. Include final seeding of all areas identified on the civil drawings. Temporary seeding for SWPPP by earthwork contractor
4. Include crushed granite between concrete and building as noted on A010
5. Include supply and install of trees as noted on A010. Include $600 allowance per tree.
    a. Include tree ring and grates
6. Include Karl Forester grasses at Planting locations indicated on A010.

END OF SECTION

SECTION 00 2600 - PROCUREMENT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for submitting substitution requests for materials, products, equipment and methods of construction from those required by the Procurement Documents, during the procurement phase and prior to execution of the Owner/Contractor Agreement.

1.02 SUBSTITUTIONS (DURING THE PROCUREMENT/BIDDING PHASE)

A. The technical specification sections may have several materials, products, equipment and methods of construction specified under the same heading. Selection of a specified materials, products, equipment and methods of construction shall be at the option of the Bidder. Where materials, products, equipment and methods of construction are specified accompanied with the phrase "Or Equal", "Approved Substitution", or similar verbiage, the Bidder may submit materials, products, equipment and methods of construction for approval in accordance with the requirements of this Document.

B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect (or Construction Manager as applicable) at least seven working days prior to the date for receipt of Bids.

1. Submit each request for substitution on the Architect's "Procurement Substitution Request Form" included at the end of this Section.
2. Submit one material, product, equipment and methods of construction per request form, either duplicated from the Project Manual or available from the Architect's office.
3. Submittals not accompanied by this form properly filled in and endorsed, will be discarded without review. NO EXCEPTIONS.
4. Where specified materials, products, and equipment are accompanied by a color, pattern or finish selection, requests for substitution shall include an actual sample of the proposed color, pattern or finish for review.
5. Where multiple materials, products or equipment are specified within a single specification section, specifically identify which product you wish to substitute.

C. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or rejection of a proposed substitution shall be final.

D. Materials, products, equipment and methods of construction approved by this substitution procedure will be issued in an Addendum.

E. Refer to Section 01 2500 for requests for substitutions after execution of the Owner/Contractor Agreement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PROCUREMENT SUBSTITUTION REQUEST FORM

TO: JLG Architects
505 W Saint Germain Street, Suite 200
St. Cloud, MN 56301

Phone: 320-408-7009
Contact: Whitney Lougheed
wlougheed@jlgarchitects.com

PROJECT: Apollo Renovations and Additions BP2, Saint Cloud, Minnesota

Section Number_____ Section Title_____

Specified Product_____

Proposed Substitution_____

All of the following questions must be answered. Incomplete forms will be not be reviewed.

1. The following supporting data is attached:
   □ Drawings □ Product Data □ Samples □ Tests □ Reports
2. Does the proposed substitution affect dimensions shown on Drawings, or functional clearances?
   □ YES □ NO
3. Does the proposed substitution change the design or details shown on the Drawings?
   □ YES □ NO
4. Does the proposed substitution affect other trades?
   □ YES □ NO
5. Does the proposed substitution affect maintenance service, or source of replacement parts, if applicable?
   □ YES □ NO
6. Does the proposed guarantee or warranty differ from that specified?
   □ YES □ NO
7. If "YES" to Items 2, 3, 4, 5 or 6 above, attach a thorough explanation on your company letterhead.
8. If there are other major differences between proposed substitution and specified product, attach a thorough explanation on your company letterhead.
9. The proposed substitution was used within the last 24 months on the following project:
   Project Name_____
   Location_____
   Architect_____Telephone No._____
10. Has the proposed substitution been used on a JLG Architects project within the last 12 months?
    □ YES □ NO; If yes, which project?_____
11. The undersigned states that the function, appearance and quality of the substitution item are equivalent or superior to the specified item.

Submitted By: Firm_____ Signature_____
Address_____
Telephone_____Fax_____
Date_____ E-Mail_____

For Use By Design Consultant: □ Accepted □ Accepted As Noted □ Not Accepted □ Received Too Late

Name_____ Signature_____

Date_____ Remarks_____

SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders

B. Geotechnical Report: Entitled Proposed Apollo High School as prepared by CVT, Chosen Valley Testing, Inc. Dated November 14, 2025.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

Chosen Valley Testing, Inc.

Design Phase Geotechnical Report:

Proposed Apollo High School
1000 44th Avenue North
St. Cloud, Minnesota
CVT# 26374.25.MNS

Prepared for:

Amy Skaalerud
Executive Director of Finance & Business
St. Cloud Area School District ISD 742

c/o Eric Helminiak
Origin Design

Certification:



I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly licensed engineer under the laws of the State of Minnesota.

Colby T. Verdegan, PE
Geotechnical Engineer
Registration Number 18983
Date: November 14, 2025

Chosen Valley Testing, Inc.

Geotechnical Engineering and Testing, 414 37th Ave N, St. Cloud, Minnesota (320) 774-3500 Fax: 1-320-774-3554
Email: stcloud@chosenvalleytesting.com

Amy Skaalerud, Executive Director of Finance & Business
St. Cloud Area School District ISD 742
1201 2nd Street South
Waite Park, MN 56387
Email: amy.skaalerud@isd742.org

November 14, 2025

c/o: Eric Helminiak
Origin Design
137 Main Street
Suite 100
Dubuque, Iowa 52001
Cell: 563-690-6946
Email: eric.helminiak@origindesign.com

Re: Design Phase Geotechnical Evaluation
Proposed Apollo High School Improvements
1000 44th Avenue North
St. Cloud, Minnesota
CVT Project 26374.25.MNS

Dear Mr. Hay,

As authorized, we have completed the geotechnical evaluation for the proposed school improvements and improvements at Apollo High School in St. Cloud, Minnesota. This letter briefly summarizes the findings in the attached report.

Summary of Boring Results

Most of the borings were drilled in green areas and met sandy topsoil to depths of about ½ to 2 feet. One boring was drilled in a paved area and met about 10 inches of pavement materials overlying another layer of buried pavement to a depth of 2 feet.

Below the surficial layers, most of the borings met fill or soils suspected to be fill and termed "possible fill" to depths of about 4 to 14 feet. The fill soils were typically dark colored. The possible fill in the ball filed areas was also dark and might be natural B-Horizon soil. The deep possible fill in the building areas tended to be light brown and did not include any obvious indications of fill, such as debris or mixing, and might be engineered fill from construction of the existing facility.

Below the fill, the borings encountered glacial outwash deposits consisting of clean sands (poorly graded sand to poorly graded sand with silt). Most of the borings terminated in these soils.

The borings drilled at for the storm shelter addition had an overall similar profile as the other borings but met silty and/or clayey soils at the bottom of the profile and terminated in those soils.

Water was observed in all but one of the borings from depths of 10 to about 20 feet. These depths correspond to elevations between 1022 feet and 1030 ½ feet. We would expect groundwater levels to fluctuate similarly to nearby lakes and rivers, along with local weather patterns.

Summary of Analysis and Recommendations

The topsoil and paving materials should be removed from below the building areas, along with any fill, foundations, utilities or other unsuitable materials. At the building locations explored, the topsoil materials appear to be about ½ to 2 feet thick. The fill appeared to extend to depths of about 4 to 9 feet below the surface with most being around 6 ½ feet.

The deep possible fill appeared to extend to about 12 or 14 feet. For planning purposes, we typically recommend assuming that plans be based on removing the possible fill materials, subject to closer review during grading. Because of the depth and location of that material relative to existing site structures, we recommend reviewing this situation more closely in advance of the construction. – with additional exploration and/or review of construction records. If the material is confirmed to be fill, rammed aggregate piers or other specialized treatment options may be more feasible than standard soil corrections.

We recommend using clean sands as replacement fill where needed. The natural sands and deep possible fill sands would likely be suitable. The dark nature of the existing fill suggests it includes spoil material from the initial construction and would be difficult to reuse.

Foundations are expected to bear upon native sands or engineered granular fill overlying the native soils. Based on the understood structural loads, and with proper implementation of our recommendations, we are of the opinion that foundations may be designed to exert a bearing pressure of up to 4,000 psf. Total post construction settlement of footings supporting the maximum projected foundation loads is expected to be less than 1 inch. Differential settlement for footings that are similarly loaded is expected to be ½ inch or less.

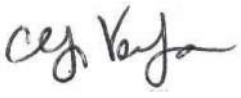
Remarks

We appreciate the opportunity to serve you. If you have any questions about our report, please feel free to contact us at (651) 756-7384.

Sincerely,
Chosen Valley Testing, Inc.



Hannah Fischer
Graduate Geological Engineer



Colby T. Verdegan, PE
Sr. Geotechnical Engineer

TABLE OF CONTENTS

A. INTRODUCTION 2

A.1. Purpose 2
A.2. Scope 2
A.3. Boring Locations and Elevations 2
A.4. Geologic Background 2

B. SUBSURFACE DATA 3

B.1. Stratification 3
B.2. Penetration Test Results 4
B.3. Groundwater Data 5

C. DESIGN DATA 5

D. ANALYSIS 5

E. BUILDING RECOMMENDATIONS 6

E.1. Grading Recommendations 6
E.1.a. Soil Corrections 6
E.1.b. Geotechnical Review of Bearing Soils 7
E.1.c. Oversizing 7
E.1.d. Surface Compaction, Filling and Compaction 7
E.2. Building Design 7
E.2.a. Foundation Depth 7
E.2.b. Bearing Capacity 7
E.2.c. Settlement 8
E.2.d. Vapor Barrier 8
E.2.e. Slab Design 8
E.2.f. Lateral Support/Resistance 8

F. PAVEMENT RECOMMENDATIONS 8

F.1. Stripping and Grading 8
F.2. Pavement Design 9

G. ESTIMATED INFILTRATION 9

H. CONSTRUCTION TESTING AND DOCUMENTATION 10

H.1. Excavation 10
H.2. Dewatering 10
H.3. Cold Weather 10
H.4. Construction Testing and Documentation 10

I. LEVEL OF CARE 10

APPENDIX 11

Design Phase Geotechnical Report
Proposed Apollo High School Improvements
1000 44th Avenue North
St. Cloud, Minnesota

CVT Project Number: 26374.25.MNS
Date: November 14, 2025

A. Introduction

The intent of this report is to present our findings to the client in the same logical sequence that led us to arrive at the opinions and recommendations expressed. Since our services often must be completed before the design is finished, assumptions are often needed to prepare a proper scope and to analyze the data. A complete and thorough review of the entire document, including its assumptions and its appendices, should be undertaken immediately upon receipt.

A.1. Purpose

This geotechnical report was prepared to aid in the design and construction of the proposed additions and improvements for Apollo High School in St. Cloud, Minnesota. Our services were authorized by Amy Skaalerud, Executive Director of Finance & Business of the St. Cloud Area School District ISD 742. The design firm for this project is Origin Design.

A.2. Scope

To obtain data for analysis, a total of fourteen (14) borings were authorized and drilled at the site. Eight (8) building addition borings were drilled to the planned depth of about 25 feet and six (6) borings to depths of about 15 feet in the ball field areas. Our engineering scope consisted of providing this report summarizing our procedures, findings and geotechnical recommendations for the proposed improvements.

A.3. Boring Locations and Elevations

The boring locations were indicated to Chosen Valley Testing Inc. on a site plan provided by the client. The Boring Location Sketch in the Appendix of this report shows the approximate locations of the borings as drilled and was made by superposing GPS coordinates for the borings onto aerial imagery, using Google Earth software.

Ground surface elevations at the borings were estimated to the nearest ½-foot from LiDAR topographic data available by the Minnesota Department of Natural Resources using their online software "MnTOPO".

A.4. Geologic Background

A geotechnical report is based on subsurface data collected for the specific structure or problem. Available geologic data from the region can help interpretation of the data and is briefly summarized in this section.

Geologic maps indicate the soils in the area are dominated by glacial outwash. Bedrock is commonly on the order of 50 to 100 feet below the surface and is not a consideration for this project.

B. Subsurface Data

The borings were performed using penetration test procedures (Method of Test D1586 of the American Society for Testing and Materials). This procedure allows for the extraction of intact soil specimen from deep in the ground. With this method, a hollow-stem auger is drilled to the desired sampling depth. A 2-inch OD sampling tube is then screwed onto the end of a sampling rod, inserted through the hole in the auger's tip, and then driven into the soil with a 140-pound hammer dropped repeatedly from a height of 30 inches above the sampling rod. The sampler is driven 18 inches into the soil, unless the material is too hard. The samples are generally taken at 2½ to 5-foot intervals. The core of soil obtained was classified and logged by the driller on site and a representative portion was then sealed and delivered to the geotechnical engineer for further review.

B.1. Stratification

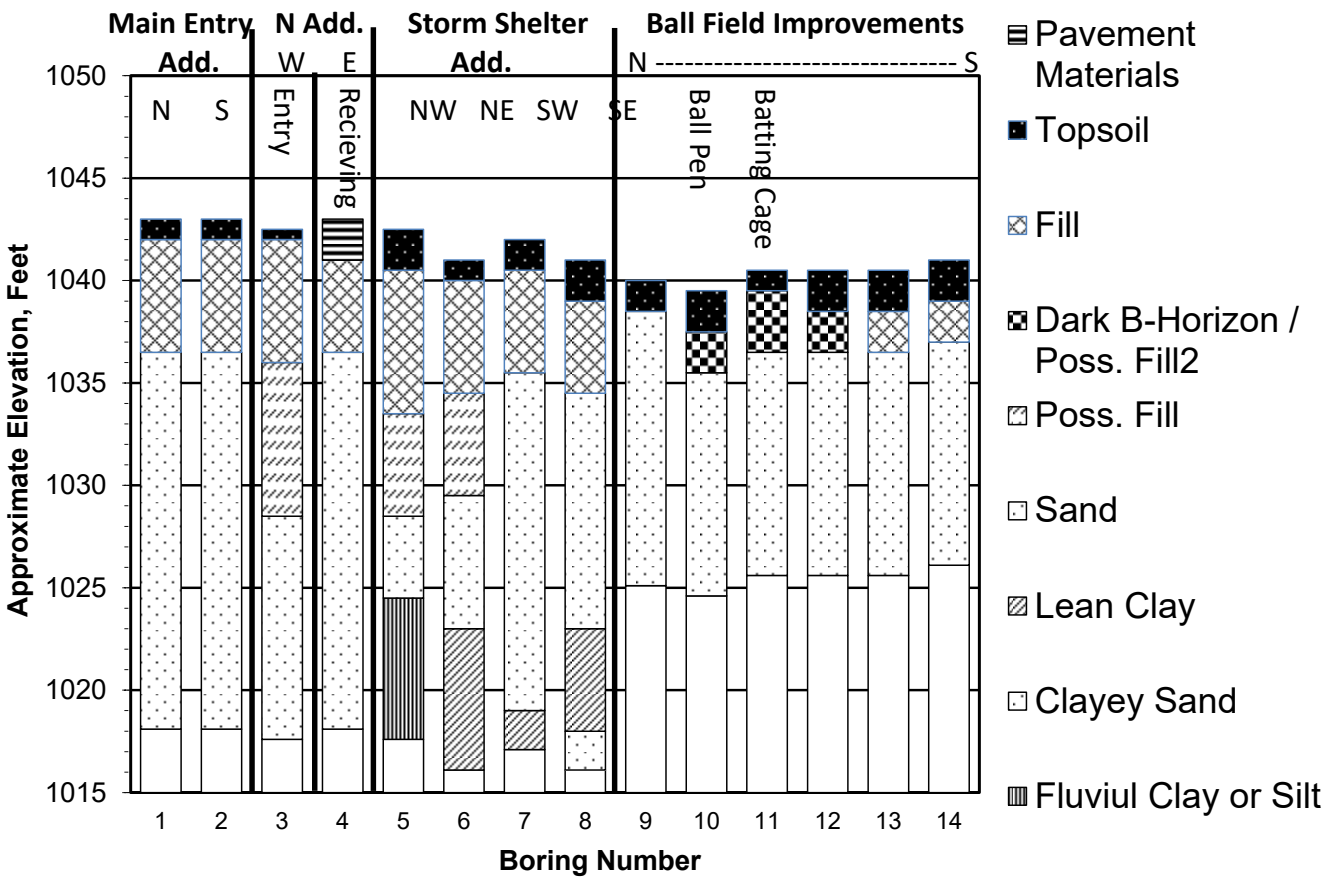
Most of the borings were drilled in green areas and met sandy topsoil to depths of about ½ to 2 feet. One boring was drilled in a paved area and met about 10 inches of pavement materials overlying another layer of buried pavement to a depth of 2 feet.

Below the surficial layers, most of the borings met fill or soils suspected to be fill and termed “possible fill” to depths of about 4 to 14 feet. The fill soils were typically dark colored. The possible fill in the ball filed areas was also dark and might be natural B-Horizon soil. The deep possible fill in the building areas tended to be light brown and did not include any obvious indications of fill, such as debris or mixing, and might be engineered fill from construction of the existing facility.

Below the fill, the borings encountered glacial outwash deposits consisting of clean sands (poorly graded sand to poorly graded sand with silt). Most of the borings terminated in these soils.

The borings drilled at for the storm shelter addition had an overall similar profile as the other borings but met silty and/or clayey soils at the bottom of the profile and terminated in those soils.

The boring data has been summarized in the following cross-section. Please refer to the individual Log of Boring sheets in the Appendix for more detailed information.



B.2. Penetration Test Results

The number of blows needed for the hammer to advance the penetration test sampler is an indicator of soil characteristics. The number of blows to advance the sampler 1 foot is called the penetration resistance or "N"-value. The results tend to be more meaningful for natural mineral soils than for fill soils. In fill soils, compaction tests are more meaningful.

Most of the fill and possible fill returned penetration resistance values ("N" Values) of 10 to 32 blows per foot (BPF), suggesting it was likely compacted. The exception was the fill at the north entry which had values of 4 to 6 BPF. The natural sands returned penetration values of 9 to 20 BPF indicating they were loose to medium dense, but mostly medium dense. The natural clays and silts returned values of 8 to 12 BPF indicated they were medium to rather stiff.

A key to descriptors used to qualify the relative density of soil (such as *soft*, *stiff*, *loose*, and *dense*) can be found on the Legend to Soil Description in the Appendix.

A pocket penetrometer was used to estimate the compressive strength of the cohesive soils. Values of ¼ to 1 ton per square foot (tsf) were recorded in the glacial till clays. Values of ¼ to greater than ½ tsf were recorded in the glacial fluvium clays and silts.

B.3. Groundwater Data

During drilling, the drillers may note the presence of moisture on the sampler, in the cuttings, or in the borehole itself. These findings are reported on the boring logs. Because water levels vary with weather, time of year, and other factors, the presence or lack of water during exploration is subject to interpretation and is not always conclusive.

Water was observed in all but one of the borings from depths of 10 to about 20 feet. These depths correspond to elevations between 1022 feet and 1030 ½ feet. We would expect groundwater levels to fluctuate similarly to nearby lakes and rivers, along with local weather patterns.

C. Design Data

Because each structure has a different loading configuration and intensity, different grades, and different structural or performance tolerances, the results of a geotechnical exploration will mean different things for different facilities. If the facility changes, Chosen Valley Testing should be contacted to discuss possible implications of the changes. Without a chance to review such changes, the recommendations of the soils engineer may no longer be valid or appropriate.

The project consists of the construction of several additions to the school including a gymnasium/storm shelter, new entries, and offices. The building additions are to be one-story tall and are assumed to be slab-on-grade structures.

Design information and loads were provided to us by Origin Design. The 12,000 s.f. gymnasium is to be constructed primarily of precast walls and roofing with maximum bearing wall loads of about 18 klf and non-load bearing continuous footings with loads of about 5 klf. The receiving addition will be 1,000 s.f. and is to be constructed of a combination of CMU, brick, and steel beams and columns with structural footing loads of 2.5 klf and maximum column loads of 15 kips. The northwest entry will be 750 s.f. and constructed of steel columns, steel beams, and a precast wall. Maximum bearing wall loads are assumed to be on the order of 3 klf and maximum column loads are to be about 10 kips. The 5,200 s.f. main entry and office addition will be constructed of a combination of steel columns and steel beams or joists, and a precast wall. The maximum footing loads will be 2 klf and the maximum column loads will be 70 kips.

We have assumed finished grades will be close to that of the existing building, which is believed to be about elevation 1044 feet based on MnTOPO ground surface elevations.

The ball field improvements appear to consist of a new batting cage and ball pen as well as new or upgraded paved areas around the ball fields. Infiltration areas may also be required.

D. Analysis

The topsoil and paving materials should be removed from below the building areas, along with any fill, foundations, utilities or other unsuitable materials. At the building locations explored, the topsoil materials appear

to be about ½ to 2 feet thick. The fill appeared to extend to depths of about 4 to 9 feet below the surface with most being around 6 ½ feet.

The deep possible fill appeared to extend to about 12 or 14 feet. For planning purposes, we typically recommend assuming that plans be based on removing the possible fill materials, subject to closer review during grading. Because of the depth and location of that material relative to existing site structures, we recommend reviewing this situation more closely in advance of the construction. – with additional exploration and/or review of construction records. If the material is confirmed to be fill, rammed aggregate piers or other specialized treatment options may be more feasible than standard soil corrections.

We recommend using clean sands as replacement fill where needed. The natural sands and deep possible fill sands would likely be suitable. The dark nature of the existing fill suggests it includes spoil material from the initial construction and would be difficult to reuse.

Foundations are expected to bear upon native sands or engineered granular fill overlying the native soils. Based on the understood structural loads, and with proper implementation of our recommendations, we are of the opinion that foundations may be designed to exert a bearing pressure of up to 4,000 psf. Total post construction settlement of footings supporting the maximum projected foundation loads is expected to be less than 1 inch. Differential settlement for footings that are similarly loaded is expected to be ½ inch or less.

The remainder of this report provides more details of our recommendations for the proposed structure.

E. Building Recommendations

E.1. Grading Recommendations

E.1.a. Soil Corrections: The topsoil, paving materials and fill are not suitable for support and should be removed from all building areas, along with any deeper root zones, old foundations, utilities, or other deleterious materials that may be discovered during construction. The tabulation shows the apparent depth (rounded to the nearest half foot) of these materials at the boring locations in the building area and also includes the possible fill materials as well.

Building Area	Boring ID	Approx. Ground Surface Elev. (feet)	Apparent Depth of Unsuitable Soils (feet)	Approx. Elevation at Bottom of Unsuitable Soils (feet)
NW Entry	B-01	1043	6 ½	1036 ½
NE Receiving	B-02	1042 ½	6 ½ (14)	1036 (1028 ½)
Main Entry	B-03	1043	6 ½	1036 ½
	B-04	1043	6 ½	1036 ½
Storm Shelter/ Gymnasium	B-05	1042 ½	9 (14)	1033 ½ (1028 ½)
	B-06	1041	6 ½ (11 ½)	1034 ½ (1029 ½)

	B-07	1042	6 ½	1035 ½
	B-08	1041	6 ½	1034 ½
Ball Pen	B-23	1039 1/2	2	1037 ½
Batting Cage	B-24	1040 1/2	1 (2)	1039 ½ (1038 ½)

( ) Depth of excavation including possible fill

E.1.b. Geotechnical Review of Bearing Soils: We recommend that Chosen Valley Testing be retained to evaluate the localized soil conditions once they are better exposed. Subject to that review, additions or changes to our recommendations may be deemed warranted.

E.1.c. Oversizing: Any stripping or corrective excavations should be oversized at least 1 foot beyond the foundations for each foot of fill needed below footing grade. This oversizing can be reduced by up to 50% if rather precise staking is present during grading.

E.1.d. Surface Compaction, Filling and Compaction: Exposed soils within 2 feet of the bottom of the footing trenches for the storm shelter should be surface compacted by several passes of a large turtle type compactor or similar implement.

All fill materials below the building, in the oversized areas, or used as backfill of walls should be compacted to a minimum of 95% of its maximum standard Proctor density (ASTM D 698).

For ease in compaction, we recommend using clean sands or gravels having less than 12% particles passing a number 200 sieve where fill is need below footings or slabs. The natural sands and deep possible fill sands that classify as poorly graded sands or poorly graded sands with silt would be expected to meet this gradation. The dark nature of the existing fill suggests it includes spoil material from the initial construction and would be difficult to reuse. For that reason, we recommend assuming that the obvious fill soils are not suitable.

We recommend placing a layer of cleaner sand, having less than 5% particles passing the number 200 sieve, as fill in the upper 4 to 6 inches of the subgrade of slab areas which will receive floor coverings or coatings that are less permeable than concrete.

E.2. Building Design

E.2.a. Foundation Depth: We recommend placing foundations at least 42 inches below the exposed ground surface for frost protection. Footings for unheated structures should ideally be placed 60 inches below the surface.

E.2.b. Bearing Capacity: Foundations are expected to bear upon native clean sands or engineered fill overlying native soils. Based on the understood structural loads, and with proper implementation of our recommendations, we are of the opinion that foundations for the building additions may be designed to exert a bearing pressure of up to 4,000 psf. This capacity includes a safety factor of at least 3 against shear failure.

E.2.c. Settlement: Based on a bearing capacity of 4,000 psf, total settlements under the maximum projected foundation loads are expected to be less than 1 inch. Differential settlement for footings that are similarly loaded is expected to be ½ inch or less.

E.2.d. Vapor Barrier: If the slab will receive coverings that are less permeable than concrete, a vapor barrier should be placed below the slab. Some contractors prefer to place this barrier below the sand, to limit the potential for curling.

E.2.e. Slab Design: The completed slab subgrade is expected to consist of relatively clean granular fill sand overlying relatively clean natural sands. We recommend using a modulus of subgrade reaction of 200 pci for the predominately sand subgrade.

E.2.f. Lateral Support/Resistance: Backfill placed against retaining walls/below grade walls should be compacted to at least 95% of its maximum standard Proctor density (ASTM D 698). Lateral resistance will depend on the materials used. We recommend clean sands or gravels having less than 10% particles passing a #200 sieve as fill around below-grade walls. The following table includes recommended support values for clean sands. These values do not include a safety factor.

Poorly Graded Sands (SP) 95% standard Proctor density	
Internal Friction Angle (degrees)	34
Cohesion (psf)	0
Coefficient of Friction between Concrete and Soil	0.5
Moist Unit Weight (pcf)	120
Backslope Behind Wall (degrees)	0 (Flat)
At-Rest Coefficient (Ko)	0.44
Active Coefficient (Ka)	0.28
Passive Coefficient (Kp)	3.54
Equivalent At-Rest Fluid Earth Pressure (psf/ft of wall height)	55

The actual loads exerted on the structure will depend on the movement or flexure of the structure. For sand fill, horizontal movement or flexure of about 0.2% of the height of soil retained may be sufficient to mobilize frictional forces from the at-rest state to the active state.

F. Pavement Recommendations

F.1. Stripping and Grading

We recommend stripping all existing topsoil from below pavements along with any otherwise unsuitable materials that may be encountered within 2 feet below the pavements. Below this depth, it should be adequate to strip the root zone. At the locations explored, about 1 to 2 feet of removal would be expected.

New fill needed in paved areas should consist of a uniform soil type. To promote uniformity with the existing soils, we recommend using cleaner sands or gravels having less than 12% particles passing a #200 sieve.

Fill placed in the upper 3 feet of the subgrade should be compacted to at least 100% of its maximum standard Proctor density. Below 3 feet, compaction to at least 95% is recommended. Compaction to 90% is usually sufficient in green areas.

The completed pavement subgrade should be able to pass a proof roll test using a loaded tandem axle truck. Areas not passing the proof roll test should be reworked and stabilized as needed to pass the test roll.

F.2. Pavement Design

Pavement subgrades are expected to consist of relatively clean sands. We recommend using an R-value of 50 for pavement design. We recommend a pavement section consisting of at least 3 1/2 inches of asphalt over 6 inches of class 5 aggregate base in auto traffic areas. In heavy traffic areas, we recommend at least 4 inches of asphalt over 8 inches of aggregate base. These pavement sections should be considered preliminary and subject to review by the civil consultant, based on more specific traffic volumes and their experience with pavement performance in the project area.

G. Estimated Infiltration

The borings encountered generally clean sands. The following table presents the recommended infiltration rate per soil type from the MPCA Minnesota Storm Water Manual (updated from Version 2X). Please see the individual Log of Boring sheets in the Appendix for soil classification details at each location and depth.

Unified Soil Classification System, USCS	Infiltration Rate (inches/hour)
Poorly Graded Sand (SP)	0.8
Poorly Graded Sand with Silt (SP-SM)	0.8
Silty Sand (SM)	0.2 to 0.45

The poorly graded sands typically have much higher infiltration rates than the MPCA table rates. Our experience is that silty sands tend to have much lower rates. Infiltration of undocumented fill soils are also difficult to assess due to less predictable variations in soil composition and density. Double ring infiltrometer testing is strongly recommended to provide site specific infiltration values and would need to be performed at the bottom of the infiltration structures.

H. Construction Testing and Documentation

H.1. Excavation

Stripping can likely be performed with a variety of equipment, although rubber-tired traffic tends to have difficulty on sand subgrades. A backhoe is recommended for deep excavations. The dominant soils are expected to classify as Type C soils, as defined by OSHA.

H.2. Dewatering

As noted before, water was encountered from 10 to 20 feet below the surface. Because of the high permeability of the dominant sands, dewatering wells or sand points would likely be needed to excavations into the water table.

H.3. Cold Weather

If the excavation occurs during freezing temperatures, good winter construction practices should be used. Frozen fill should be thawed before placing and filling should not take place on frozen ground. Slab areas should be completely thawed prior to placing concrete.

H.4. Construction Testing and Documentation

The bottom of the excavations should be evaluated and documented by qualified geotechnical personnel to assess the soils at bearing depth. Fill placed below building areas should be evaluated for conformance to the project gradation recommendations and should be tested for compaction. If filling proceeds during periods of freezing weather, full-time testing should be considered to help confirm that imported fill is thawed prior to and during compaction, and that all snow has been removed before placement of the fill.

Although our firm offers testing services relating to civil and structural components of the structure (such as concrete testing, reinforcement observations, etc.), specification of such services is beyond our work scope and the designer should be consulted as to such requirements.

I. Level of Care

The services provided for this project have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area, under similar budget and time constraints. This is our professional responsibility. No other warranty, expressed or implied, is made.

Appendix

Boring Location Sketch

Log of Boring # 1-8, 14-15, 22-25

Legend to Soil Description

Chosen Valley Testing, Inc.

Legend

Boring Locations

Boring Location Sketch

Apollo High School Improvements
1000 44th Avenue North,
St. Cloud, Minnesota
Project Number: CVT 26374.25.MNS

N



LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-01** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1043.0	0.0					
1042.4	0.6		**7 INCHES BITUMINOUS** .			Elevations were estimated using the MnDNR's program MnTopo and should be considered approximate.
1042.2	0.8		**3 INCHES AGGREGATE BASE**.			
1041.9	1.1		**3 INCHES BITUMINOUS**.			
1041.0	2.0		**11 INCHES AGGREGATE BASE**.			
		SP SM	**FILL**, Poorly Graded Sand with Silt, fine-to-medium grained, trace Gravel, dark brown, moist.	32		MC=3.9%
				24		MC=3.4%
1036.5	6.5					
		SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	15		MC=3.8%
1034.0	9.0					
		SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	14		MC=4.8%
1031.5	11.5					
		SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, gray, moist, medium dense. (Glacial Outwash)	15		MC=4.2%
				11		MC=4.8%
			Below 20 feet, water-bearing, trace Gravel, and coarse grained.	11	▽	MC=17.1%
				14		MC=18.1%
1018.1	24.9					
			End Boring. Water was encountered at 20 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-02** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1042.5	0.0					
1042.0	0.5	SM	**TOPSOIL**, Slightly Organic Silty Sand, trace Roots, moist.			
		SP SM	**FILL**, Poorly Graded Sand with Silt, fine-to-medium grained, trace Gravel, dark brown, moist.	19		
				24		
1036.0	6.5					
		SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Possible Fill)	29		Minimal sample returned due to cobble or gravel disuption.
				17		
			At 12 feet, brown and dark brown mixing.	27		
1028.5	14.0					
		SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-coarse grained, trace Gravel, brown, water-bearing, medium dense. (Glacial Outwash)	16	▽	
				15		
				13		
1017.6	24.9					
			End Boring. Water was encountered at 15 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-03** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1043.0	0.0					
1042.0	1.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, dark brown, moist.			
		SM	**FILL**, Silty Sand, fine-to-medium grained, trace Gravel, dark brown, moist.			
				5		MC=8.4%
				5		MC=7.9%
1036.5	6.5					
		SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	17		MC=4.7%
1034.0	9.0					
		SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	14		MC=4.1%
				15		MC=3.9%
			At 15 feet, water-bearing.	12	▽	MC=12.6%
1025.0	18.0					
		SP	**POORLY GRADED SAND WITH GRAVEL**, fine-to-coarse grained, brown, water-bearing, medium dense. (Glacial Outwash)	11		MC=14.1%
				11		MC=8.3%
1018.1	24.9					
			End Boring. Water was encountered at 15 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-04** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1043.0	0.0					
1042.0	1.0	SM	**TOPSOIL**, Slightly Organic Silty Sand, dark brown, moist.			
		SM	**FILL**, Silty Sand, fine-to-medium grained, trace Gravel, dark brown, moist.	4		
				6		
1036.5	6.5	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	16		
1034.0	9.0	SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	16		
				15		
			At 15 feet, fine-to-coarse grained and water-bearing.	14	▽	
1025.0	18.0	SP	**POORLY GRADED SAND WITH GRAVEL**, fine-to-coarse grained, brown, moist, medium dense. (Glacial Outwash)	14		
				13		
1018.1	24.9		End Boring. Water was encountered at 15 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-05** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1042.5	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, dark brown, moist.			
1040.5	2.0	SM	**FILL**, Silty Sand, fine-to-medium grained, trace Gravel, dark brown, moist.	18		MC=9.9%
1037.0	5.5		At 5 feet, black.	17		MC=16.3%
1036.0	6.5	SP SM	**FILL**, Poorly Graded Sand with Silt, fine-to-medium grained, dark brown, moist.			
1033.5	9.0	SP	**FILL**, Poorly Graded Sand, fine-to-medium grained, brown, moist.	12		MC=4.6%
1028.5	14.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Possible Fill) At 12 feet, brown and black mixing.	14 11		MC=3.9% MC=5.4%
1024.5	18.0	SP	**POORLY GRADED SAND WITH GRAVEL**, coarse grained, brown, water-bearing, medium dense. (Glacial Outwash)	10	▽	MC=14.2%
1019.5	23.0	CL	**LEAN CLAY**, gray, wet, rather stiff. (Glacio-Fluvium)	9		PP=0.5 tsf, MC=28.4%
1017.6	24.9	CL ML	**INTERBEDDED LAYERS OF LEAN CLAY AND SILT**, gray, wet, rather stiff. (Glacio-Fluvium)	9		PP=0.25 tsf, MC=27%
			End Boring. Water was encountered at 15 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-06** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1041.0	0.0					
1040.0	1.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, dark brown, moist.			
		SM	**FILL**, Silty Sand, fine-to-medium grained, trace Gravel, trace Roots, dark brown, moist.	19		
				18		
1034.5	6.5	SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Possible Fill)	12		
			At 10 feet, trace Silty Sand, black and brown mixing.	14		
1029.5	11.5	SP	**POORLY GRADED SAND WITH GRAVEL**, coarse grained, trace Gravel, brown, water-bearing, medium dense. (Glacial Outwash)	15	▽	
				11		
1023.0	18.0	CL	**LEAN CLAY**, gray, wet, medium. (Glacial Till)	8		PP=0.75 tsf
1016.1	24.9			8		PP=1 tsf
			End Boring. Water was encountered at 12 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-07** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1042.0	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, dark brown, moist.			
1040.5	1.5	SM	**FILL**, Silty Sand, fine-to-medium grained, trace Gravel, dark brown, moist.	13		MC=8.1%
			At 5 feet, black.	12		MC=15.5%
1035.5	6.5	SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	10		MC=4%
1033.0	9.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	11		MC=6.4%
1030.5	11.5	SM	**SILTY SAND**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Till) Heavy Gravel at 12 feet.	11		MC=8%
				11		MC=6.9% Minimal sample returned due to cobble or gravel disuption.
			Heavy Gravel at 20 feet.	16	▽	MC=8.5%
1019.0	23.0	CL	**LEAN CLAY**, gray, wet, rather stiff. (Glacial Till)	12		PP=0.5 tsf, MC=33.6%
1017.1	24.9		End Boring. Water was encountered at 20 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-08** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1041.0	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, trace Roots, dark brown, moist.			
1039.0	2.0	SM	**FILL**, Silty Sand, fine-to-medium grained, trace Gravel, dark brown, moist.	13		
			At 5 feet, black.	10		
1034.5	6.5	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, loose. (Glacial Outwash)	9		
				10		
				9	▽	
				15		Minimal sample returned due to cobble or gravel disuption.
1023.0	18.0	CL	**LEAN CLAY**, gray, wet, rather stiff. (Glacial Till)	11		PP=0.25 tsf
1018.0	23.0	SC	**CLAYEY SAND**, fine-to-coarse grained, trace Gravel, gray, water-bearing, loose. (Glacial Till)	10		
1016.1	24.9		End Boring. Water was encountered at 12 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-14** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1040.5	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, trace Roots, dark brown, moist.			
1038.5	2.0	SP	**FILL**, Poorly Graded Sand, fine-to-medium grained, trace Gravel, dark brown, moist.	9		
1036.5	4.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist to 14 1/2 feet then water bearing, medium dense. (Glacial Outwash)	10		
				11		
				12		
				11		
1025.6	14.9			12	▽	
			End Boring. Water was encountered at 14 1/2 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-15** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1041.0	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, trace Roots, brown, moist.			
1039.0	2.0	SP	**FILL**, Poorly Graded Sand, fine-to-medium grained, trace Gravel, brown and dark brown mixing, moist.	10		
1037.0	4.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist to 14 1/2 feet then water bearing, medium dense. (Glacial Outwash)	11		MC=3.7%
				11		
				12		MC=3.9%
				12		
1026.1	14.9			20	▽	MC=10.1%
			End Boring. Water was encountered at 14 1/2 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-22** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1040.0	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, trace Roots, dark brown, moist.			
1038.5	1.5	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, brown, moist, medium dense. (Glacial Outwash)	21		
1036.0	4.0	SP	**POORLY GRADED SAND**, fine-to-medium grained, brown, moist, medium dense. (Glacial Outwash)	12		
				12		
1031.0	9.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist to 14 1/2 feet then water bearing, medium dense. (Glacial Outwash)	11		
				11		
1025.1	14.9			13	▽	
			End Boring. Water was encountered at 14 1/2 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-23** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1039.5	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, trace Roots, dark brown, moist.			
1037.5	2.0	SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, dark brown, moist, medium dense. (B-Horizon)	16		
1035.5	4.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, brown, moist to 14 1/2 feet then water bearing, medium dense. (Glacial Outwash)	35		Minimal sample returned due to cobble or gravel disuption.
				14		
			Below 10 feet, trace Gravel.	12		MC=7.9%
				13		
1024.6	14.9			11	▽	MC=12.2%
			End Boring. Water was encountered at 14 1/2 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-24** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1040.5	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, trace Roots, dark brown, moist.			
1039.5	1.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, dark brown, moist, medium dense. (B-Horizon)	13		
1036.5	4.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	17		
				13		Minimal sample returned due to cobble or gravel disuption.
			Below 10 feet, water-bearing.	12	▽	
				15		Minimal sample returned due to cobble or gravel disuption.
1025.6	14.9			15		
			End Boring. Water was encountered at 10 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 26374.25.MNS Design Phase Geotechnical Evaluation Apollo High School and Multi-Purpose Athletic Facility 1000 44th Avenue North St. Cloud, Minnesota	BORING: **B-25** LOCATION: See attached sketch. DATE: SCALE: 1" = 4'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1040.5	0.0	SP SM	**TOPSOIL**, Poorly Graded Sand with Silt, trace Roots, dark brown, moist.			
1038.5	2.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, dark brown, moist, medium dense. (B-Horizon)	11		
1036.5	4.0	SP SM	**POORLY GRADED SAND WITH SILT**, fine-to-medium grained, trace Gravel, brown, moist, medium dense. (Glacial Outwash)	12		MC=5.2%
				14		
				13		MC=2.6%
				12		
1025.6	14.9			13		MC=12.3%
			End Boring. Water was not observed. Boring was sealed upon completion.			

CVT STANDARD 26374.25.MNS (APOLLO HIGH SCHOOL AND MAC).GPJ LOG A GNNN06.GDT 11/14/25

UNIFIED SOIL CLASSIFICATION (ASTM D-2487/2488)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS<"A" LINE	ML	SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY
			PI PLOTS <"A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT

Relative Proportions of Sand and Gravel

TERM	PERCENT
Trace	< 15
With	15 - 29
Modifier	> 30

Relative Proportions of Fines

TERM	PERCENT
Trace	< 5
With	5 - 12
Modifier	> 12

Grain Size Terminology

TERM	SIZE
Boulder	< 12 in.
Cobble	3 in. - 12 in.
Gravel	#4 sieve to 3 in.
Sand	#200 sieve to #4 sieve
Silt or Clay	Passing #200 sieve

SAMPLE TYPES

Hollow Stem

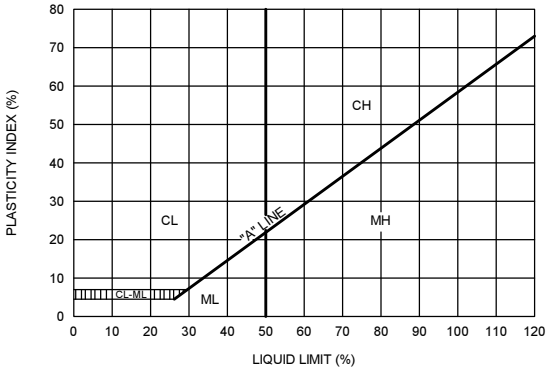
Standard Penetration Test

TEST SYMBOLS

MC	-	MOISTURE CONTENT	LL	-	LIQUID LIMIT
OC	-	ORGANIC CONTENT	PI	-	PLASTISITY INDEX
CN	-	CONSOLIDATION	SW	-	SWELL TEST
DD	-	DRY DENSITY	UU		Unconsolidated Undrained triaxial
PP	-	POCKET PENETROMETER			
RV	-	R-VALUE			
SA	-	SIEVE ANALYSIS			
P200	-	% PASSING #200 SIEVE			

- WATER LEVEL (WITH TIME OF) MEASUREMENT

PLASTICITY CHART



PENETRATION RESISTANCE
(RECORDED AS BLOWS / 0.5 FT)

SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 1	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 3	0.25 - 0.50
MEDIUM DENSE	10 - 30	RATHER SOFT	4 - 5	0.50 - 1.0
DENSE	30 - 50	MEDIUM	6 - 8	
VERY DENSE	OVER 50	RATHER STIFF	9 - 12	1.0 - 2.0
		STIFF	13 - 16	
		VERY STIFF	17 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

Chosen Valley Testing, Inc.

Job No. 14202.18.MNR

LEGEND TO SOIL DESCRIPTIONS

CVT

CVT 14202.18.MNR (PRESTON VETERAN'S HOME).GPJ 1/10/19

SECTION 00 4113 - BID FORM

BID DATE: Thursday, October 29th, 2026, not later than 2:00 PM local time.

TO: Attn: Amy Skaalerud
St. Cloud Area School District #742
1201 2nd Street South
Waite Park, MN 56387

PROJECT: Apollo Additions and Renovations BP2 – REBID #2
1000 44th Ave N
St. Cloud, MN 56303

ARCHITECT: JLG Architects
505 West Saint Germain Street – Suite 200
St. Cloud, MN 56301

The undersigned, having become familiar with site of proposed Project and Bidding and Contract Documents for Project noted above, hereby proposes to provide Work per Contract Documents at Sum stated below.

CONTRACTORS NAME: _____

ADDENDA

Bidder hereby acknowledges receipt of the following Addenda. Modifications to Bid Documents noted therein have been considered and cost thereto is included in Base Bid Sum

Addendum Numbers _____

BASE BID

Bid Category: Description: _____
(Provide Bid Category Number and Description as it appears in 00 2413)

Bidder agrees to provide the work for the Bid Category above for the lump sump of:

($ _____) _____
(Number) (Words)

ALTERNATES:

NOT APPLICABLE

BID SECURITY

Accompanying this proposal is the Bid Security specified in Advertisement for Bids, the same being subject to forfeiture in the event of default by the undersigned.

ACKNOWLEDGMENTS

Bidder, in submitting this Bid, certifies that Bid is based upon careful examination of Bidding and Contract Documents and waives all rights to plead any misunderstanding.

Bidder, in submitting this Bid, understands that Owner reserves the right to reject any or all Bids, to waive any informality or irregularity in any Bid received, and to accept any Alternate(s) in any order or combination.

Bidder, in submitting this Bid, acknowledges that Bidder has read and fully understands Project Manual Document 001113- Advertisement for Bids.

RESPONSIBLE CONTRACTOR: By submitting a bid for the above-named project, per Minnesota State Statute Chapter 16C.285-RESPONSIBLE CONTRACTOR REQUIREMENT DEFINED, the undersigned is confirming that the Contractor meets the minimum criteria defining a Responsible Contractor as listed in Minnesota State Statute Chapter 16C.285 – RESPONSBILE CONTACTOR REQUIREMENT DEFINED. Subdivision 3. Minimum Criteria

CONTRACTOR PERSONNEL

Project Manager's Name: _____

Project Manager's Email:_____

BIDDER IDENTIFICATION

THE UNDERSIGNED operates as:

( ) incorporated in the State _____ ( ) a Partnership ( ) a Proprietorship

LEGAL NAME OF PERSON, FIRM OR CORPORATION

Legal Name: _____

Address: _____

Telephone: _____Facsimile. _____

E-mail:_____

By: Title: (Signature of Authorized Signing Officer)

Company License No.: _____

Federal ID Number (if applicable) _____

RESPONSIBLE CONTRACTOR ACT – VERIFICATION OF COMPLIANCE

STATE OF MINNESOTA)

) ss.

COUNTY OF)

Project Name and Number: _____

I, _____, solemnly affirm under oath that I am an owner or officer of _____ ("the Contractor") and state under oath that:

1. The Contractor meets all of the minimum criteria established in subdivision 3 of the Minnesota Responsible Contractor Law, Minnesota Statute section 16C.285; and any additional criteria that the contracting authority has included in the definition of responsible contractor in the bidding documents.

2. All subcontractors that the Contractor intends to retain have verified to the Contractor through a signed statement under oath by an owner or officer that they also meet the same minimum criteria, and that they have listed the subcontractors they intend to retain. Subject to the Contractor's right to add subcontractors, those subcontractors are:

   _____

   _____

   _____

   _____

   _____

   _____

3. I declare under penalty of perjury that, to the best of my knowledge, everything I have stated in this document is true.

Title: _____

Subscribed and sworn to before me this _ day of _____ 20 _____

_____

Notary Public

END OF SECTION

SECTION 00 5213 - AGREEMENT FORMS

PART 1 - GENERAL

1.1 PROJECT

Apollo Renovations and Additions BP2
1000 44th Ave N
St. Cloud, MN 56303

The following AIA Agreement Form will be used for Project. Standard Form of Agreement Between Owner and Contractor, Construction Manager as Advisor Edition AIA A132-2019
Refer to next page for agreement form to be used

AIA® Document A132™ – 2019

Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition

AGREEMENT made as of the day of in the year
(In words, indicate day, month, and year.)

BETWEEN the Owner:
(Name, legal status, address, and other information)

and the Contractor:
(Name, legal status, address, and other information)

for the following Project:
(Name, location, and detailed description)

The Construction Manager:
(Name, legal status, address, and other information)

The Architect:
(Name, legal status, address, and other information)

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

This document is intended to be used in conjunction with AIA Documents A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser. AIA Document A232™–2019 is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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User Notes: (1699445351)

TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND DATES OF SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS
EXHIBIT B DETERMINATION OF THE COST OF THE WORK

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND DATES OF SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion of the Project or Portions Thereof

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the date of Substantial Completion of the Work of all of the Contractors for the Project will be:
(Insert the date of Substantial Completion of the Work of all Contractors for the Project.)

Init.
/

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§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of all of the Contractors for the Project are to be completed prior to Substantial Completion of the entire Work of all of the Contractors for the Project, the Contractors shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.4 When the Work of this Contract, or any Portion Thereof, is Substantially Complete

§ 3.4.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall substantially complete the entire Work of this Contract:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.4.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of this Contract are to be substantially complete prior to when the entire Work of this Contract shall be substantially complete, the Contractor shall substantially complete such portions by the following dates:

Portion of Work	Date to be substantially complete

§ 3.4.3 If the Contractor fails to substantially complete the Work of this Contract, or portions thereof, as provided in this Section 3.4, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be one of the following:
(Check the appropriate box.)

[ ] Stipulated Sum, in accordance with Section 4.2 below

[ ] Cost of the Work plus the Contractor's Fee, in accordance with Section 4.3 below

[ ] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 4.4 below

(Based on the selection above, complete Section 4.2, 4.3 or 4.4 below.)

§ 4.2 Stipulated Sum

§ 4.2.1 The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2.2 Alternates

§ 4.2.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

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Item	Price	Conditions for Acceptance

§ 4.2.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.2.4 Unit prices, if any:
(Identify the item and state the unit price, and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.3 Cost of the Work Plus Contractor's Fee without a Guaranteed Maximum Price
§ 4.3.1 The Cost of the Work is as defined in Exhibit B, Determination of the Cost of the Work.

§ 4.3.2 The Contractor's Fee:
(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee.)

§ 4.3.3 The method of adjustment of the Contractor's Fee for changes in the Work:

§ 4.3.4 Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

§ 4.3.5 Rental rates for Contractor-owned equipment shall not exceed percent (%) of the standard rental rate paid at the place of the Project.

§ 4.3.6 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.3.7 The Contractor shall prepare and submit to the Construction Manager, within 14 days of executing this Agreement, a written Control Estimate for the Owner's review and approval. The Control Estimate shall include the items in Section B.1 of Exhibit B, Determination of the Cost of the Work.

§ 4.4 Cost of the Work Plus Contractor's Fee with a Guaranteed Maximum Price
§ 4.4.1 The Cost of the Work is as defined in Exhibit B, Determination of the Cost of the Work.

§ 4.4.2 The Contractor's Fee:
(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee.)

§ 4.4.3 The method of adjustment of the Contractor's Fee for changes in the Work:

§ 4.4.4 Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

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§ 4.4.5 Rental rates for Contractor-owned equipment shall not exceed percent (%) of the standard rental rate paid at the place of the Project.

§ 4.4.6 Unit Prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.4.7 Guaranteed Maximum Price

§ 4.4.7.1 The Contract Sum is guaranteed by the Contractor not to exceed ($), subject to additions and deductions by Change Order as provided in the Contract Documents. This maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner.

§ 4.4.7.2 Alternates

§ 4.4.7.2.1 Alternates, if any, included in the Guaranteed Maximum Price:

Item	Price

§ 4.4.7.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.4.7.3 Allowances, if any, included in the Guaranteed Maximum Price:
(Identify each allowance.)

Item	Price

§ 4.4.7.4 Assumptions, if any, upon which the Guaranteed Maximum Price is based:
(Identify each assumption.)

§ 4.4.8 To the extent that the Contract Documents are anticipated to require further development, the Guaranteed Maximum Price includes the costs attributable to such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include changes in scope, systems, kinds and quality of materials, finishes, or equipment, all of which, if required, shall be incorporated by Change Order.

§ 4.4.9 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in Section 4.4.7.4. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the agreed-upon assumptions contained in Section 4.4.7.4 and the revised Contract Documents.

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any, to be assessed in accordance with Section 3.4.)

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§ 4.6 Other:
(Insert provisions for bonus, cost savings or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Construction Manager by the Contractor, and Certificates for Payment issued by the Construction Manager and Architect, the Owner shall make progress payments on account of the Contract Sum, to the Contractor, as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Construction Manager not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Construction Manager receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum

§ 5.1.4.1 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Construction Manager and Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.4.2 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.4.3 In accordance with AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.4.3.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.4.3.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A232–2019;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232–2019; and

.5 Retainage withheld pursuant to Section 5.1.7.

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§ 5.1.5 Progress Payments Where the Contract Sum is Based on the Cost of the Work without a Guaranteed Maximum Price

§ 5.1.5.1 With each Application for Payment, the Contractor shall submit the cost control information required in Exhibit B, Determination of the Cost of the Work, along with payrolls, petty cash accounts, receipted invoices, or invoices with check vouchers attached, and any other evidence required by the Owner, Construction Manager or Architect to demonstrate that payments already made by the Contractor on account of the Cost of the Work equal or exceed progress payments already received by the Contractor, plus payrolls for the period covered by the present Application for Payment, less that portion of the payments attributable to the Contractor's Fee.

§ 5.1.5.2 Applications for Payment shall show the Cost of the Work actually incurred by the Contractor through the end of the period covered by the Application for Payment and for which the Contractor has made or intends to make actual payment prior to the next Application for Payment.

§ 5.1.5.3 In accordance with AIA Document A232-2019 and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.5.3.1 The amount of each progress payment shall first include:

.1 The Cost of the Work as described in Exhibit B, Determination of the Cost of the Work;

.2 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified; and

.3 The Contractor's Fee computed upon the Cost of the Work described in the preceding Section 5.1.5.3.1.1 at the rate stated in Section 4.3.2; or if the Contractor's Fee is stated as a fixed sum in Section 4.3.2 an amount which bears the same ratio to that fixed-sum Fee as the Cost of the Work included in Section 5.1.5.3.1.1 bears to a reasonable estimate of the probable Cost of the Work upon its completion.

§ 5.1.5.3.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A232–2019;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232–2019;

.5 The shortfall, if any, indicated by the Contractor in the documentation required by Section 5.1.5.1 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and

.6 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.5.4 The Owner, Construction Manager and Contractor shall agree upon a mutually acceptable procedure for review and approval of payments to Subcontractors and the percentage of retainage held on Subcontracts, and the Contractor shall execute subcontracts in accordance with those agreements.

§ 5.1.5.5 In taking action on the Contractor's Applications for Payment, the Construction Manager and Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Contractor, and such action shall not be deemed to be a representation that (1) the Construction Manager and Architect have made a detailed examination, audit or arithmetic verification of the documentation submitted in accordance with Article 5 or other supporting data; (2) that the Construction Manager and Architect have made exhaustive or continuous on-site inspections; or (3) that the Construction Manager and Architect have made examinations to ascertain how or for what purposes the Contractor has used amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

§ 5.1.5.6 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.1.5.7 If final completion of the Work is materially delayed through no fault of the Contractor, then the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A232-2019.

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§ 5.1.6 Progress Payments Where the Contract Sum is Based on the Cost of the Work with a Guaranteed Maximum Price

§ 5.1.6.1 With each Application for Payment, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner, Construction Manager or Architect to demonstrate that payments already made by the Contractor on account of the Cost of the Work equal or exceed progress payments already received by the Contractor plus payrolls for the period covered by the present Application for Payment, less that portion of the progress payments attributable to the Contractor's Fee.

§ 5.1.6.2 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Guaranteed Maximum Price among: (1) the various portions of the Work; (2) any contingency for costs that are included in the Guaranteed Maximum Price but not otherwise allocated to another line item or included in a Change Order; and (3) the Contractor's Fee.

§ 5.1.6.2.1 The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Construction Manager and Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.6.2.2 The allocation of the Guaranteed Maximum Price under this Section 5.1.6.2 shall not constitute a separate guaranteed maximum price for the Cost of the Work of each individual line item in the schedule of values.

§ 5.1.6.2.3 When the Contractor allocates costs from a contingency to another line item in the schedule of values, the Contractor shall submit supporting documentation to the Architect and Construction Manager.

§ 5.1.6.3 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. The percentage of completion shall be the lesser of (1) the percentage of that portion of the Work which has actually been completed; or (2) the percentage obtained by dividing (a) the expense that has actually been incurred by the Contractor on account of that portion of the Work and for which the Contractor has made payment or intends to make payment prior to the next Application for Payment by (b) the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values.

§ 5.1.6.4 In accordance with AIA Document A232-2019, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.4.1 The amount of each progress payment shall first include:

.1 That portion of the Guaranteed Maximum Price properly allocable to completed Work as determined by multiplying the percentage of completion of each portion of the Work by the share of the Guaranteed Maximum Price allocated to that portion of the Work in the most recent schedule of values;

.2 That portion of the Guaranteed Maximum Price properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction or, if approved in writing in advance by the Owner, suitably stored off the site at a location agreed upon in writing;

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified; and

.4 The Contractor's Fee, computed upon the Cost of the Work described in the preceding Sections 5.1.6.4.1.1 and 5.1.6.4.1.2 at the rate stated in Section 4.4.2 or, if the Contractor's Fee is stated as a fixed sum in that Section, an amount that bears the same ratio to that fixed-sum fee as the Cost of the Work included in Sections 5.1.6.4.1.1 and 5.1.6.4.1.2 bears to a reasonable estimate of the probable Cost of the Work upon its completion.

§ 5.1.6.4.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A232–2019;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

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.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232–2019;

.5 The shortfall, if any, indicated by the Contractor in the documentation required by Section 5.1.6.1 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and

.6 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.6.5 The Owner and the Contractor shall agree upon a mutually acceptable procedure for review and approval of payments to Subcontractors and the percentage of retainage held on Subcontracts, and the Contractor shall execute subcontracts in accordance with those agreements.

§ 5.1.6.6 In taking action on the Contractor's Applications for Payment, the Construction Manager and Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Contractor and such action shall not be deemed to be a representation that (1) the Construction Manager or Architect have made a detailed examination, audit, or arithmetic verification of the documentation submitted in accordance with Section 5.1.6.1 or other supporting data; (2) that the Construction Manager or Architect have made exhaustive or continuous on-site inspections; or (3) that the Construction Manager or Architect have made examinations to ascertain how or for what purposes the Contractor has used amounts previously paid on account of the Contract. Such examinations, audits, and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

§ 5.1.6.7 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.1.6.8 If final completion of the Work is materially delayed through no fault of the Contractor, then the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A232-2019.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to when the Work of this Contract is substantially complete, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to when the entire Work of this Contract is substantially complete, including modifications for completion of portions of the Work as provided in Section 3.4.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, when the Work of this Contract is substantially complete, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted when the Work of this Contract is substantially complete shall not include retainage as follows:
(Insert any other conditions for release of retainage when the Work of this Contract is substantially complete, or upon Substantial Completion of the Work of all Contractors on the Project or portions thereof.)

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§ 5.2 Final Payment

§ 5.2.1 Final Payment Where the Contract Sum is Based on a Stipulated Sum

§ 5.2.1.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A232–2019, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect.

§ 5.2.1.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the final Certificate for Payment or Project Certificate for Payment, or as follows:

§ 5.2.2 Final Payment Where the Contract Sum is Based on the Cost of the Work with or without a Guaranteed Maximum Price

§ 5.2.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A232–2019, and to satisfy other requirements, if any, which extend beyond final payment;

.2 the Contractor has submitted a final accounting for the Cost of the Work, pursuant to Exhibit B, Determination of the Cost of the Work and a final Application for Payment; and

.3 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect in accordance with Exhibit B, Determination of the Cost of the Work.

§ 5.2.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the final Certificate for Payment or Project Certificate for Payment, or as follows:

§ 5.3 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as Initial Decision Maker pursuant to Article 15 of AIA Document A232–2019, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A232–2019, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Article 15 of AIA Document A232–2019.

[ ] Litigation in a court of competent jurisdiction.

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[ ] Other: *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 Where the Contract Sum is a Stipulated Sum

§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2019.

§ 7.1.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A232–2019, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019.

§ 7.2 Where the Contract Sum is Based on the Cost of the Work with or without a Guaranteed Maximum Price

§ 7.2.1 Termination

§ 7.2.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2019.

§ 7.2.1.2 Termination by the Owner for Cause

§ 7.2.1.2.1 If the Owner terminates the Contract for cause as provided in Article 14 of AIA Document A232–2019, the Owner shall then only pay the Contractor an amount as follows:

.1 Take the Cost of the Work incurred by the Contractor to the date of termination;

.2 Add the Contractor's Fee, computed upon the Cost of the Work to the date of termination at the rate stated in Section 4.3.2 or 4.4.2, as applicable, or, if the Contractor's Fee is stated as a fixed sum in that Section, an amount that bears the same ratio to that fixed-sum Fee as the Cost of the Work at the time of termination bears to a reasonable estimate of the probable Cost of the Work upon its completion;

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract the costs and damages incurred, or to be incurred, by the Owner under Article 14 of AIA Document A232–2019.

§ 7.2.1.2.2 When the Contract Sum is based on the Cost of the Work with a Guaranteed Maximum Price, if the Owner terminates the Contract for cause as provided in Article 14 of AIA Document A232-2019, the amount, if any, to be paid to the Contractor under Article 14 of AIA Document A232-2019 shall not cause the Guaranteed Maximum Price to be exceeded, nor shall it exceed the amount calculated in Section 7.2.1.2.1.

§ 7.2.1.2.3 The Owner shall also pay the Contractor fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Contractor that the Owner elects to retain and that is not otherwise included in the Cost of the Work under Section 7.2.1.2.1.1. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Contractor shall, as a condition of receiving the payments referred to in this Article 7, execute and deliver all such papers and take all such steps, including the legal assignment of such subcontracts and other contractual rights of the Contractor, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Contractor under such subcontracts or purchase orders. All Subcontracts, purchase orders and rental agreements entered into by the Contractor will contain provisions allowing for assignment to the Owner as described above.

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§ 7.2.1.3 Termination by the Owner for Convenience
If the Owner terminates the Contract for convenience in accordance with Article 14 of AIA Document A232–2019, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of or method for determining the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.3 Suspension
The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019; in such case, the Contract Sum and Contract Time shall be increased as provided in Article 14 of AIA Document A232–2019, except that the term "profit" shall be understood to mean the Contractor's Fee as described in Section 4.3.2 or 4.4.2, as applicable, of this Agreement.

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232–2019 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds
§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A132™–2019, Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A232–2019, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

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§ 8.7 Relationship of the Parties

Where the Contract is based on the Cost of the Work plus the Contractor's Fee, with or without a Guaranteed Maximum Price, the Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and exercise the Contractor's skill and judgment in furthering the interests of the Owner; to furnish efficient business administration and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner's interests. The Owner agrees to furnish and approve, in a timely manner, information required by the Contractor and to make payments to the Contractor in accordance with the requirements of the Contract Documents.

§ 8.8 Other provisions:

The Owner may by separate document appoint Contractor as its Purchasing Agent to act on behalf of the Owner in the purchase and acquisition of materials, supplies, and equipment (the "Materials") to be installed, used in, or incorporated into the Project. Contractor and the Owner agree that if such appointment is made by Owner such purchase activities by Contractor shall be undertaken in a manner as to be exempt from Minnesota Sales and Uses Taxes in accordance with Minnesota Statutes and regulations adopted thereunder.

To the extent required to acquire Materials under this Agreement, Contractor is authorized to and may appoint some or all of its subcontractors as additional purchasing agents to purchase items. For the primary subcontractors who will be purchasing a significant amount of Materials, i.e. in the amount of $1,000 or more, Contractor shall secure a Purchasing Agent Agreement signed by the subcontractor and shall in all cases be responsible for insuring that the subcontractors it selects for the Project maintain accurate and sufficient records to establish that the purchases of Materials made by them were made for the purposes of the Project and for the sole benefit of the Owner.

Contractor, on behalf of the Owner, shall purchase Materials in accordance with the specifications of the Contract Documents and during the time periods necessary for Contractor to comply with the Agreement. Contractor shall be entitled to be reimbursed by the Owner for the cost of the Materials. The cost of the Materials shall reflect discounts, rebates, and refunds, Contractor shall be obligated to purchase the materials for the Owner's account at purchase prices subject to additions and deductions by Change Order.

Title to the Materials purchased by Contractor pursuant to its duties as Purchasing Agent shall immediately vest in the Owner at the point of delivery thereof. Contractor shall file no materialmen's lien nor maintain any claim against the Owner's real estate or improvements for or on account of any items purchased under the authority granted in this Agreement. The Owner shall have the right of entry and free access to the Project at all times and the right to inspect all items of the Materials installed or stored in and about the Project.

Contractor, as Purchasing Agent, shall receive delivery of all items of the Materials ordered by Contractor on behalf of the Owner hereunder, and shall exercise reasonable care consistent with construction industry customs in inspecting such items to ascertain that they are free of patent defects and conform to appropriate specifications before preliminarily accepting delivery on behalf of the Owner, provided that final acceptance from a supplier or vendor shall be conditioned upon completed installation and proper performance thereof as determined by the Architect. Except with respect to its obligations to exercise reasonable care under this Section, Contractor makes no warranty as to the Materials purchased and shall have no obligation to the Owner for items which are not accepted by the Owner or are rejected by the Owner after acceptance.

Contractor shall exercise reasonable care and take reasonable precautions for safekeeping of all Material in its custody prior to installation, use or incorporation in the Project, Risk of loss, damage and destruction with respect to the Materials shall be that of the Owner.

All defective Materials installed or used in or incorporated in to the Project shall be responsibility of the Owner, provided however, that Contractor as Purchasing Agent shall retain liability for its negligent acts and omissions, including the purchase of items that do not meet specifications of the Contract Documents, Contractor shall, if requested by the Owner, act as the Owner's agent in resolving disputes with materialmen as to defective materials, subject to the Owner's final approval.

Contractor and any directed subcontractors shall assert the Owner's exemption from Minnesota sales and use taxes with

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respect to all items of the Materials which Contractor or its subcontractors purchase as agents for the Owner by (a) delivering a copy of the Owner's Letter of Exemption; and (b) placing the following legend upon all orders for the purchase of such items:

> "This purchase is made by the undersigned on behalf of and as purchasing agent for St. Cloud Area School District #742, a Minnesota school district, which is exempt from sales and use taxation upon its purchases for school district purposes. This purchase qualifies for tax exempt treatment and should not be subject to taxation.
>
> Title to all materials and supplies purchased under this order shall pass directly from the Seller to St. Cloud Area School District #742, which is solely responsible payment. Invoices should be submitted and deliveries made to the undersigned as purchasing agent for St. Cloud Area School District #742. A copy of the Form ST3, Certificate of Exemption or a purchase order or payment voucher that clearly shows that the school is a government entity shall serve as proof of the exemption."

As Purchasing Agent, Contractor shall collect and process all invoices or other statements from vendors or suppliers, shall submit payment requests to the Owner for approval for payment, and shall, upon receipt of necessary funds, disburse such funds to the appropriate vendors and suppliers on behalf of the Owner. Payment requests under this Section shall be submitted with and subject to the same provisions as payment requests under Article 5 of the Agreement. Contractor shall execute reasonable and diligent efforts in performing the foregoing payment disbursement functions and maintain proper written records thereof. Contractor, as Purchasing Agent, shall furnish adequate notification to all vendors and suppliers that the obligation for payments due to such vendors and suppliers for project materials, supplies and equipment is that of the Owner and not Contractor, Contractor shall maintain and provide to the Owner, at least once each calendar year and upon request, an itemization of all items of the Material purchased which are exempt from sales tax and the amount of sales tax savings.

In connection with Contractor's performance of its duties as Purchasing Agent, the Owner shall provide to Contractor a copy of the Owner's Letter of Exemption issued by the State of Minnesota, Department of Revenue.

Upon request by the Owner, Contractor shall disclose the names of all persons with whom it contracts with respect to purchase of the Materials under this Agreement.

Contractor shall keep accounting records in connection with its performance under this Agreement for a period of three years after final payment or for such longer period as may be required by law.

If Contractor is obligated to pay any sales tax or use tax with respect to any items of the Materials purchased under the authority granted in this Agreement, the Owner shall be solely responsible for the payment of such tax. The Owner shall indemnify, defend, and hold Contractor harmless from and against, the amount of any such tax penalty or interest which becomes payable by Contractor directly or on behalf of its subcontractors or vendors by reason of valid order of the State of Minnesota, together with any costs of litigation and reasonable attorney's fee incurred, provided however, that Contractor shall notify the Owner that the State of Minnesota is making a claim for such payment and afford the Owner the opportunity to contest such claim. At its sole option, the Owner may dispute, contest, or otherwise challenge the imposition or assessment of any such sales or use tax, without expense to Contractor, and in such event shall establish an escrow sufficient to pay any such liability, by letter of credit, or other means satisfactory to Contractor. Any subcontractors appointed by Contractor as additional Purchasing Agents shall be a third party beneficiary of this Section 8.8.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- **.1** AIA Document A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition
- **.2** AIA Document A132™–2019, Exhibit A, Insurance and Bonds Exhibit
- **.3** AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition
- **.4** AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:

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(Insert the date of the E203-2013 incorporated into this Agreement.)

N/A

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document A132™–2019, Exhibit B, Determination of the Cost of the Work

[ ] AIA Document E235™–2019, Sustainable Projects Exhibit, Construction Manager as Adviser Edition, dated as indicated below:
(Insert the date of the E235-2019 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A232–2019 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

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This Agreement is entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

Init.
/

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SECTION 00 6100 - BOND FORMS

PART 1 - GENERAL

1.1 PERFORMANCE BOND

A. Owner requires Contractor to provide Performance Bond and Payment Bond in the full amount of the contract

END OF SECTION

SECTION 00 6213 - CERTIFICATE OF INSURANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sample Certificate of Insurance Accord.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

*** All endorsements must accompany COI

ACORD®

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

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	CONTACT NAME:
	PHONE (A/C, No, Ext): / FAX (A/C, No):
	E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Insurance Carrier	
INSURER B :	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED: SAMPLE

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	GENERAL LIABILITY [X] COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC	X	X	POLICY NUMBER			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 $
X	AUTOMOBILE LIABILITY [X] ANY AUTO [ ] ALL OWNED AUTOS [ ] SCHEDULED AUTOS [X] HIRED AUTOS [X] NON-OWNED AUTOS	X	X	POLICY NUMBER			COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$ 1,000,000 $ $ $ $
A	[X] UMBRELLA LIAB [X] OCCUR [ ] EXCESS LIAB [ ] CLAIMS-MADE [ ] DED [X] RETENTION $ 10,000			POLICY NUMBER			EACH OCCURRENCE AGGREGATE $	$ 1,000,000 $ 1,000,000 $
X	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICE/MEMBER EXCLUDED? Y/N [N] (Mandatory In NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N/A	X	POLICY NUMBER			WC STATU-TORY LIMITS / OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 500,000 $ 500,000 $ 500,000

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

PROJECT NAME :Apollo High School Additions and Renovations BP2

Additional Insured, Bradbury Stamm Construction Winkelman, LLC including completed operations, on the general liability per written contract: The General Liability and Auto policies include an automatic Additional Insure endorsement that provides Additional Insured status to the Certificate Holder, only when there is a written contract or written agreement between the named insured and the certificate holder and with regard to work performed on behalf. The General Liability, Auto and Workers Compensation policies provide a Blanket Waiver of Subrogation in favor of the same, when required by written contract.

The General Liability policy contains a special endorsement with"Primary and Noncontributory" wording, when required by written contract.

CERTIFICATE HOLDER

Bradbury Stamm Construction Winkelman, LLC
340 Highway 10 South
St Cloud MN 56304

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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Additional Insured : St Cloud Area School District & Bradbury Stamm

Clear All

SECTION 00 6523 – WITHHOLDING AFFIDAVIT FOR CONTRACTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Withholding Affidavit for Contractors Form: Upon final completion of Project, completely fill out entire Minnesota Revenue Form IC 134.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

AIA® Document A232™ – 2019

General Conditions of the Contract for Construction, Construction Manager as Adviser Edition

for the following PROJECT:
(Name, and location or address)

THE CONSTRUCTION MANAGER:
(Name, legal status, and address)

THE OWNER:
(Name, legal status, and address)

THE ARCHITECT:
(Name, legal status, and address)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

This document is intended to be used in conjunction with AIA Documents A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 OWNER

3 CONTRACTOR

4 ARCHITECT AND CONSTRUCTION MANAGER

5 SUBCONTRACTORS

6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

7 CHANGES IN THE WORK

8 TIME

9 PAYMENTS AND COMPLETION

10 PROTECTION OF PERSONS AND PROPERTY

11 INSURANCE AND BONDS

12 UNCOVERING AND CORRECTION OF WORK

13 MISCELLANEOUS PROVISIONS

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents. The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract. The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

§ 1.1.3 The Work. The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project. The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Contractors, and by the Owner's own forces and Separate Contractors.

§ 1.1.5 Contractors. Contractors are persons or entities, other than the Contractor or Separate Contractors, who perform Work under contracts with the Owner that are administered by the Architect and Construction Manager.

§ 1.1.6 Separate Contractors. Separate Contractors are persons or entities who perform construction under separate contracts with the Owner not administered by the Architect and Construction Manager.

§ 1.1.7 The Drawings. The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.8 The Specifications. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.9 Instruments of Service. Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.10 Initial Decision Maker. The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

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§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

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

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building

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Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Construction Manager and the Architect do not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work, and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,

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assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Unless otherwise provided under the Contract Documents, the Owner, assisted by the Construction Manager, shall secure and pay for the building permit.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 The Owner shall retain a construction manager adviser lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.4 If the employment of the Construction Manager or Architect terminates, the Owner shall employ a successor construction manager or architect to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

§ 2.3.5 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.6 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.7 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3.8 The Owner shall forward all communications to the Contractor through the Construction Manager. Other communication shall be made as set forth in Section 4.2.6.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to review by the Construction Manager and prior approval of the Architect, and the Construction Manager or Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Construction Manager's and Architect's and their respective consultants' additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction

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where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.5, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Construction Manager and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Construction Manager in such form as the Construction Manager and Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Construction Manager and Architect any nonconformity discovered by or made known to the Contractor as a request for information submitted to Construction Manager in such form as the Construction Manager and Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner, the Construction Manager, and the Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. The Construction Manager shall review the proposed alternative for sequencing, constructability, and coordination impacts on the other Contractors. Unless the Architect or the Construction Manager objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of the Project already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect, in consultation with the Construction Manager, and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner, Construction Manager, and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner, assisted by the Construction Manager, shall secure and pay for the building permit. The Contractor shall secure and pay for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or

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(2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect and Construction Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect, in consultation with the Construction Manager, determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner, Construction Manager, and Contractor, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner, Construction Manager, and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents:

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect, through the Construction Manager, of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Construction Manager may notify the Contractor, stating whether the Owner, the Construction Manager, or the Architect (1) has reasonable objection to the proposed superintendent or (2) require additional time for review. Failure of the Construction Manager to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner, Construction Manager, or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

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§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information, and the Construction Manager's use in developing the Project schedule, a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Contractors, or the construction or operations of the Owner's own forces or Separate Contractors.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Construction Manager's and Architect's approval. The Architect and Construction Manager's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Construction Manager and Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall participate with other Contractors, the Construction Manager, and the Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule.

§ 3.10.4 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner, Construction Manager, and Architect, and incorporated into the approved Project schedule.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Construction Manager, Architect, and Owner, and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data, and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.10 through 4.2.12. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Construction Manager, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract

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Documents, in accordance with the Project submittal schedule approved by the Construction Manager and Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Contractors, Separate Contractors, or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples, and similar submittals with related documents submitted by other Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner, Construction Manager, and Architect, that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been reviewed and approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Construction Manager and Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner, the Architect, and the Construction Manager shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Construction Manager shall review submittals for sequencing, constructability, and coordination impacts on other Contractors.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Construction Manager and Architect at the time and in the form specified by the Architect.

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§ 3.13 Use of Site

§ 3.13.1 The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner, Separate Contractors, or of other Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner, Separate Contractors, or by other Contractors except with written consent of the Construction Manager, Owner, and such other Contractors or Separate Contractors. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Separate Contractors, other Contractors, or the Owner, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner, Construction Manager, and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner, Construction Manager, and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner, Architect, or Construction Manager. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect through the Construction Manager.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 The Construction Manager is the person or entity retained by the Owner pursuant to Section 2.3.3 and identified as such in the Agreement.

§ 4.1.3 Duties, responsibilities, and limitations of authority of the Construction Manager and Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Construction Manager, Architect, and Contractor. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment. The Construction Manager and Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the site visits, the Architect will keep the Owner and the Construction Manager reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner and Construction Manager known deviations from the Contract Documents and defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner and Architect reasonably informed of the progress of the Work, and will promptly report to the Owner and Architect known deviations from the Contract Documents and the most recent Project schedule, and defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will schedule and coordinate the activities of the Contractor and other Contractors in accordance with the latest approved Project schedule.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of, or be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

§ 4.2.6 Communications. The Owner shall communicate with the Contractor and the Construction Manager's consultants through the Construction Manager about matters arising out of or relating to the Contract Documents. The Owner and Construction Manager shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Construction Manager otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with other Contractors shall be

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through the Construction Manager. Communications by and with the Owner's own forces and Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

§ 4.2.8 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents, and will notify each other about the rejection. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, upon written authorization of the Owner, whether or not the Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.9 Utilizing the submittal schedule provided by the Contractor, the Construction Manager shall prepare, and revise as necessary, a Project submittal schedule incorporating information from other Contractors, the Owner, Owner's consultants, Owner's Separate Contractors and vendors, governmental agencies, and participants in the Project under the management of the Construction Manager. The Project submittal schedule and any revisions shall be submitted to the Architect for approval.

§ 4.2.10 The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data, and Samples. Where there are other Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from the Contractor and other Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

§ 4.2.11 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.12 Review of the Contractor's submittals by the Construction Manager and Architect is not conducted for the purpose of determining the accuracy and completeness of other 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 the Contractor as required by the Contract Documents. The Construction Manager and Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Construction Manager and Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.13 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.2.14 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7, and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

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§ 4.2.15 Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples, and similar required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

§ 4.2.16 The Construction Manager will assist the Architect in conducting inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

§ 4.2.17 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Construction Manager of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.18 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of the Construction Manager, Owner, or Contractor through the Construction Manager. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.19 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions so rendered in good faith.

§ 4.2.20 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.21 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing, through the Construction Manager, to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include other Contractors or Separate Contractors or the subcontractors of other Contractors or Separate Contractors.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Construction Manager, for review by the Owner, Construction Manager and Architect, of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Construction Manager may notify the Contractor whether the Owner, the Construction Manager or the Architect (1) has reasonable objection to any such proposed person or entity or, (2) requires additional time for review. Failure of the Construction Manager to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, that the Contractor, by these Contract Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor Contractor or other entity. If the Owner assigns the subcontract to a successor Contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor Contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

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§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces or Separate Contractors, the Owner shall provide for coordination of such forces and Separate Contractors with the Work of the Contractor, who shall cooperate with them.

§ 6.1.3 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner's own forces, Separate Contractors, Construction Manager and other Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner's own forces, Separate Contractors or other Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Construction Manager and Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor or other Contractors that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Construction Manager and the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's or other Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractors or other Contractors that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a Separate Contractors or to other Contractors, because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective construction by the Owner's own forces, Separate Contractors, or other Contractors.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction, or to property of the Owner, Separate Contractors, or other Contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner, Separate Contractors, and other Contractors shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, other Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Construction Manager, with notice to the Architect, will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Construction Manager, Architect and Contractor. A Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

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§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect, and Contractor, stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Construction Manager shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Construction Manager and Architect;
.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Construction Manager of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

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§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager and Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Construction Manager and Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Construction Manager and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Construction Manager that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner, Architect, Construction Manager, or an employee of any of them, or of the Owner's own forces, Separate Contractors, or other Contractors; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section

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15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts and the Architect, based on the recommendation of the Construction Manager, determines justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Construction Manager, before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Construction Manager and the Architect. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. The Construction Manager shall forward to the Architect the Contractor's schedule of values. Any changes to the schedule of values shall be submitted to the Construction Manager and supported by such data to substantiate its accuracy as the Construction Manager and the Architect may require, and unless objected to by the Construction Manager or the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least fifteen days before the date established for each progress payment, the Contractor shall submit to the Construction Manager an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner, Construction Manager or Architect require, such as copies of requisitions, and releases of waivers of lien from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Construction Manager and Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all

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Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 Where there is only one Contractor, the Construction Manager will, within seven days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Certificate for Payment, in the full amount of the Application for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

§ 9.4.2 Where there is more than one Contractor performing portions of the Project, the Construction Manager will, within seven days after the Construction Manager receives all of the Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Contractor's application with information from similar applications for progress payments from the other Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Contractors; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

§ 9.4.2.1 Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Project Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Project Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors.

§ 9.4.3 The Construction Manager's certification of an Application for Payment or, in the case of more than one Contractor, a Project Application and Certificate for Payment, shall be based upon the Construction Manager's evaluation of the Work and the data in the Application or Applications for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

§ 9.4.4 The Architect's issuance of a Certificate for Payment or, in the case of more than one Contractor, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and data in the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

§ 9.4.5 The representations made pursuant to Sections 9.4.3 and 9.4.4 are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Construction Manager or Architect.

§ 9.4.6 The issuance of a Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the quality

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or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.3 and 9.4.4 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.2. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

.1 defective Work not remedied;
.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor or other Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager, and both will reflect such payment on the next Certificate for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment or Project Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Construction Manager and Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Construction Manager will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor

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fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner, Construction Manager nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Construction Manager and Architect do not issue a Certificate for Payment or a Project Certificate for Payment, through no fault of the Contractor, within fourteen days after the Construction Manager's receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Construction Manager and Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Construction Manager, and the Contractor and Construction Manager shall jointly prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion.

§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work of all of the Contractors, or designated portion thereof, is substantially complete, the Construction Manager will prepare, and the Construction

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Manager and Architect shall execute, a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect after consultation with the Construction Manager.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a notice that the Work is ready for final inspection and acceptance, and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager shall perform an inspection to confirm the completion of Work of the Contractor. The Construction Manager shall make recommendations to the Architect when the Work of all of the Contractors is ready for final inspection, and shall then forward the Contractors' notices and Application for Payment or Project Application for Payment, to the Architect, who will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Construction Manager's and Architect's final Certificate for Payment or Project Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6), if required by the Owner, other data

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establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect through the Construction Manager prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors. The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor;
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction; and
- **.4** construction or operations by the Owner, Separate Contractors, or other Contractors.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

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§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner, Construction Manager and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner, Construction Manager and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the persons or entities proposed by the Owner. If the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of

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tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Construction Manager and Construction Manager's consultants, and the Architect and Architect's consultants, shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice directly to the Owner, and separately to the Construction Manager, of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the

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Contract Documents, the Owner shall inform both the Contractor and the Construction Manager, separately and in writing, prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice directly to the Contractor, and separately to the Construction Manager, of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Construction Manager and Construction Manager's consultants; (3) the Architect and Architect's consultants; (4) other Contractors and any of their subcontractors, sub-subcontractors, agents, and employees; and (5) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, other Contractors, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor, Architect, and Construction Manager for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to

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requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Construction Manager, Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Construction Manager, Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Construction Manager or Architect has not specifically requested to examine prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion, and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner, Construction Manager or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

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§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner, Separate Contractors, or other Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Construction Manager, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become

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requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Construction Manager, Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Construction Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Construction Manager for transmittal to the Architect.

§ 13.4.5 If the Construction Manager or Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Construction Manager or Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Construction Manager has not certified or the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees, or any other persons performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, after consultation with the Construction Manager, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and the Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of this Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

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.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Construction Manager and Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost. If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

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§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties, the Construction Manager, and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation

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within 30 days of receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

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§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SECTION 00 7300 - SUPPLEMENTARY CONDITIONS

The following supplements modify, change, delete from or add to the General Conditions of the Contract for Construction, AIA Document A232, 2019 Edition. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these supplements, the unaltered provisions of the Article, Paragraph, Subparagraph, or Clause of the General Conditions shall remain in effect.

ARTICLE 1. GENERAL PROVISIONS:

1.1.1 Change the last sentence to read: "The Contract Documents shall include the Bidding Documents such as the Advertisement for Bids or Invitation to Bid, the Instructions to Bidders. The Contract Documents do not include the Contractor's Bid or any other documents unless specifically enumerated in the Owner-Contractor Agreement."

1.2.4 General character and scope of Work is indicated on Drawings. Where a portion of Work is fully drawn and the remainder is merely indicated, portion fully drawn shall apply to all similar parts of Work.

1.2.5 Follow figured dimensions in preference to scaled measurements. Dimensions on the Drawings are subject to field verification to suit adjacent elements.

1.2.6 In cases of discrepancy concerning dimension, quantity, and location, the Specifications shall take precedence over the Drawings. Explanatory notes on the Drawings shall take precedence over conflicting drawn indications. Large-scale details shall take precedence over smaller scale Drawings and figured dimensions shall take precedence over scaled measurements. Where figures are not shown, scale measurements shall be followed but shall in all cases be verified by measuring actual conditions of Work already in place. In cases of discrepancy concerning quality and application of materials and non-technical requirements over materials, the Specifications shall take precedence over the Drawings.

1.2.7 In case of conflict in or between Drawings and Specifications, the Contractor will be deemed to have estimated on, and agreed to provide, the greater quantity or better quality of materials and Work unless they shall have, before submission of bid, asked for and obtained written decision of the Construction Manager as to which method or materials will be required.

1.4.1 Where Specifications are abbreviated type, they indicate complete sentences in the same manner as when a note occurs in the Drawings. Omission of words such as "the Contract shall" and "as indicated on the Drawings" are intentional. The words "shall" or "shall be" are to be supplied by inference. The term "provide" shall mean "furnish and install in place."

1.4.2 Where a number is listed in the Specifications (as for gauges, weights, temperatures, amount of time, etc.) the number shall be interpreted as that or better.

ARTICLE 2. OWNER:

No supplement.

ARTICLE 3. CONTRACTOR:

3.2.4 Add: "Submission of Bid shall be deemed evidence that the Contractor has examined the site and is familiar with conditions under which Work will be done. Signing of the Contract indicates acceptance,

by the Contractor, of conditions under which Work will be done. Extra payments will not be authorized for Work that could have been determined by a careful examination."

3.3.4 Add: "The Contractor shall be responsible to coordinate Work of all Subcontractors to expedite progress and avoid interference and shall notify Subcontractors of readiness for their Work to allow adequate time for installation without delaying completion of the Project."

3.4.4 Workmanship and Materials.

A. No Subcontractor shall commence Work until conditions are right for carrying out the Work properly and surfaces to be covered are suitable.
B. Manufacturer's printed instructions covering details of installation shall be followed where not in conflict with these Specifications. If there is a conflict, notify the Construction Manager and obtain Construction Manager's approval before proceeding.
C. Completed Work shall be left plumb, level, true to line or plane, anchored securely in place free from damage.
D. Unless otherwise called for, all pieces of material shall be a stock size as is in conformity with standard good practice of the trade.
E. Except where in conflict with these Specifications, current manufacturer's printed Specifications of herein specified proprietary products are made part of these Specifications.

3.4.5 Add: "All labor shall be performed in the best and most workmanlike manner by mechanics skilled in their respective trades. The standards of the Work required throughout shall be of such grade as will bring results of the first class only."

3.4.6 Add: "Materials and/or workmanship not in compliance with the Drawings and Specifications or improperly installed shall be removed and replaced by the Contractor with no change in Contract Amount."

3.4.7 Add: "Contractor shall familiarize himself with all the specified products and shall submit any objections they may have to the proposed use of any products in writing prior to the opening of bids."

3.4.8 Add: "Where the Contract Documents require Work better than that required by statute, the Contract Documents shall govern."

3.7.5 3.7.6 Add: "The Contractor shall pay all highway fees and for all damages to sidewalks, streets, or other public property, or to any public utilities."

3.7.7 Add: "The Contractor shall secure all certificates of inspection and of occupancy which may be required by authorities having jurisdiction over the Work, including the Board of Fire Underwriter's certificates. These shall be delivered to the Construction Manager upon completion of the Work."

3.11.1 Replace the text with: "The Contractor shall maintain at the site one copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders, and other Modifications. These shall be available to the Construction Manager during construction"

One set of prints shall be kept in good condition and marked as Work progresses by Contractor in ink to show differences of major concealed items from what is called for by the Contract Documents. This set will become the Record Set of Drawings. This set is to include such items as main pipes and conduit or changed structural members which cannot be observed on completion even with the use of access doors or removable panels. This set shall be turned over to the Construction Manager at the time of final inspection.

The Contractor shall have one Sample of interior and exterior finishes on site, in the color and/or finish shown on color schedule."

3.12.11 Add: "Submit to the Construction Manager one reproducible transparency and four prints of each Shop Drawing, including fabrication, erection, layout and setting drawings, and such other drawings as required under various Specification Sections, until final approval is obtained. Contractor is responsible for obtaining and distributing required prints of Shop Drawings to Contractor's Subcontractors and material drawings shall be made from transparencies, which carry the Construction Manager's appropriate stamp. Mechanical and electrical fixture brochures and catalog cuts shall be submitted to the engineers in six copies and shall show dimensions, performance characteristics and capacities, wiring diagrams and controls, schedules, and other pertinent information as required. Where printed materials describe more than one product or model, clearly identify which is to be furnished."

3.12.12 Add: "Manufacturer's Instructions: Where any item of Work is required by Specifications to be furnished, installed, or performed per a specified product manufacturer's instructions, Contractor shall procure and distribute the necessary copies of such instructions to all concerned parties."

3.14.3 Add: "Any Contractor requiring cutting into the Work of another Contractor shall do such cutting and shall properly repair such Work to the satisfaction of the Construction Manager. Such cutting, fitting, and patching shall not endanger any Work or otherwise alter the Work or any part of it, and it shall be done by craftspeople skilled and experienced in the trade or craft that installed or furnished the original work. Repairs shall be equal in quality and appearance to similar adjacent Work and shall not be obviously apparent as a patch or repair. Work that cannot be satisfactorily repaired shall be removed and replaced with new materials. Cutting and patching required as a result of lack of coordination or other error on the part of prime Contractors other than the General Contractor shall be performed by the General Contractor and the cost of the performance of the Work shall be borne by the prime Contractor responsible therefore."

3.15.3 Add: "Remove labels from glass, fixtures, etc. Remove spots, marks, stain prints, and dirt from painted Work, varnished Work, hardware, tile, fixtures, and concrete. Remove temporary floor coverings, clean and finish floors as recommended by manufacturers."

ARTICLE 4. ADMINISTRATION OF THE CONTRACT:

4.1.4 Add: "The Construction Manager shall assist the Owner in preparation of Bidding information, Bid Forms, Conditions of the Contract, the Agreement between Owner and the Contractor, and the procedure of determining insurance requirements. The Owner, after review, shall have final approval for these items."

4.3.7.2 Add to paragraph: "The Contractor shall, within seven days from the beginning of such delay, notify the Construction Manager, in writing, of the causes of the delay."

ARTICLE 5. SUBCONTRACTORS:

No supplement.

ARTICLE 6. CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS:

No supplement.

ARTICLE 7. CHANGES IN THE WORK:

7.2.2 Delete “may” in the first line and substitute “shall”.

7.3.3 Substitute the following for Paragraph 7.3.3: “If Construction Change Directive provides for adjustment to Contract Sum, determine value of such additional, omitted, or changed Work in either or both ways described below.

A. By unit price contained in Contractor’s original Bid and incorporated in construction Contract.

B. On basis of actual cost of materials and labor on Project site, maximum 10 percent on materials and 10 percent on labor for Contractor’s overhead and profit, which shall include cost of insurance, bond, and field supervision. If Work is done by Subcontractor, prime Contractor may add not more than 10 percent for Contractor’s general overhead and profit. In preparing Change Order, provide the following documentation:

1. Breakdown of materials and hourly breakdown of labor.
2. Incorporate supporting documents by reference on each supplement.
3. Contractor’s and consultants’ date and initials of corrections.
4. Completed Contract summary with adequate justification and supporting documentation.

7.3.10 Add: “Owner or Construction Manager are not responsible to give Notice of Change Orders to the Surety (if any).”

ARTICLE 8. TIME:

8.3.4 The following will not be considered justification for extension of time unless due to one of the causes stated within this Article.

A. Delay caused by Subcontractors or suppliers except if the supplier goes out of business and another supplier cannot be found in time to meet schedule.

B. Shortage of workers.

ARTICLE 9. PAYMENTS AND COMPLETION:

9.3.1.1 After “Section 7.3.9” Change the next section to read: “Such applications shall not include requests for payment on account of changes in the Work which have been properly authorized by Construction Directives but not yet included in Change Orders.”

9.3.4 Add: “Progress payments shall be made monthly upon application, in the amount of 95% of the work completed.”

9.6.2 Change to read: “The prime Contractor is required to pay Subcontractors within ten days of receipt of payment from the government entity or pay interest at the rate of 1 ½% per month or any part of a month to which the Subcontractor is entitled, reflecting percentages actually retained from payment to the Contractor on account of the Subcontractor’s portion of the Work. The Contractor shall by appropriated agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.”

9.8.1 Change to read: “The date of substantial completion of the work of designated portions thereof is the date when construction is sufficiently complete, in accordance with the contract documents, so the owner can occupy or utilize the work or designated portion thereof for the use for which it is intended. Minor corrective work and the replacements of defective work or materials, and the adjustment of control apparatus will not delay the determination that the Contract is substantially complete.

ARTICLE 10. PROTECTION OF PERSONS AND PROPERTY:

No supplement.

ARTICLE 11. INSURANCE AND BONDS:

Delete Article 11 and replace as follows:

11.1 CONTRACTORS INSURANCE

11.1.1 The Contractor shall purchase and maintain insurance from a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located. This insurance will protect the Contractor from claims set forth below which may arise out of, or result from, the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone for whose acts any of them may be liable.

11.1.2 Workers' Compensation and Employers Liability:

.1 Coverage A: Per state statute

.2 Coverage B: $500,000.00 Each accident
$100,000.00 Disease-policy limit
$500,000.00 Disease-each employee

11.1.3 Commercial General Liability

.1 $2,000,000.00 General aggregate.

.2 $2,000,000.00 Products-completed operations aggregate.

.3 $1,000,000.00 Each occurrence.

.4 $1,000,000.00 Personal injury.

The commercial general liability shall provide at a minimum the following coverages:

.5 Operations of the Contractor.

.6 Operations of Subcontractor. (Contingent Liability)

.7 Products/Completed Operations. (To be carried one year after completion of Contract.)

.8 Personal injury.

.9 Employees as additional insured.

.10 Property damage hazards of explosion, collapse and underground.

.11 Contractual Liability. (To insure the provisions of 4.18.1).

11.1.4 Comprehensive Automobile Liability:

.1 $1,000,000.00 Combined single limit bodily injury and property damage.

The comprehensive automobile liability shall provide coverage for the following automobiles:

.2 All owned automobiles.

.3 All non-owned automobiles.

.4 All hired automobiles.

11.1.5 Umbrella Liability

.1 $2,000,000.00 Each Claim
$2,000,000.00 Annual Aggregate

.2 The umbrella liability shall provide excess limits over and above the commercial general liability, employer's liability and comprehensive automobile liability limits as stated in this article.

11.1.6 The insurance required by 11.1.1 shall be written for the limits specified or limits required by law, whichever is greater. The coverages written on an occurrence form shall be maintained without

interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

11.1.7 Certificates of Insurance: Certificates of insurance shall be filed with the owner prior to commencement of the Work. Such certificates shall be prepared on ACORD or CICC forms. Such certificates shall contain a provision that coverages afforded shall not be canceled or non-renewed without 30 days prior written notice to the owner.

11.1.8 Owners Liability Insurance:

.1 The Contractor, at Contractor's expense, shall purchase and maintain during the life of the Contract Owner's Protective liability insurance.

.2 Such insurances shall be written with limits not less than:

$2,000,000.00 Aggregate.

$1,000,000.00 Each Occurrence.

.3 The owner's Protective liability insurance shall name as an additional insured the Construction Manager and engineer.

11.3 PROPERTY INSURANCE

11.3.1 The Owner shall purchase and maintain during the construction period Builders Risk insurance. Such insurance shall be on a Completed Value form and shall be written for an amount equal to 100% of the completed value of the Project. Such insurance will cover the Work and materials at the site, at temporary storage sites, and during transit.

11.3.1.1 Property insurance shall be written on a "Risk of Direct Physical Loss" form and shall include fire, extended coverage, vandalism and malicious mischief, theft, collapse, glass, and resultant damage from faulty Work, faulty materials, and errors and omissions in design.

11.3.1.2 Any deductible amount which may occur as part of the Builders Risk policy shall be borne by the named insureds making claims in direct proportion as their individual losses bear to the total loss and the policy deductible will be no more than $1,000.00.

11.3.1.3 Such Builders Risk policy shall allow for partial occupancy by the owner prior to completion of the Project.

11.3.1.5 The owner and all Contractors agree to waive all rights of subrogation against each other for all losses covered by the Builders Risk coverage.

11.3.1.6 The Contractor, as trustee, shall have power to adjust and settle any loss with the insurer unless one of the parties in interest shall object in writing within five days after the occurrence of loss to the Contractor's exercise of this power, and if such objection be made, arbitrators shall be chosen as provided elsewhere in this Contract. The Contractor, as trustee, shall, in that case, make settlement with the insurer per the directions of the arbitrators. If distribution of the insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

11.3.1.7 Prior to any exposure to loss, the Contractor shall file with the owner a certificate of insurance evidencing Builders Risk coverage. Such certificate shall require a 30 days advance written notice to the owner should the policy be canceled or non-renewed.

11.3.2 Boiler and Machinery: Owner shall be responsible for maintaining boiler and machinery. This includes the interests of the Owner, Contractor, and Subcontractors.

11.3.3 Loss of Use Insurance: Owner, at their option, may purchase such insurance as will insure them against, loss of use of their property due to fire or other hazards, however caused. The owner waives all rights of action against the Contractor for loss of use of their property, including consequential

losses due to fire or other hazards, however caused to the extent that the loss is covered by insurance.

11.3.4 Additional Insurance: The insurance set forth in these Documents is the minimum insurance required. Any additional coverages that may be necessary to further protect the Contractor are the sole responsibility of the Contractor.

ARTICLE 12. UNCOVERING AND CORRECTION OF WORK:

12.2.1.1 Add: “The corrective Work shall conform in the aspects with the original intent of the Contract Documents.”

ARTICLE 13. MISCELLANEOUS PROVISIONS:

No supplement.

ARTICLE 14. TERMINATION OR SUSPENSION OF THE CONTRACT:

No supplement.

ARTICLE 15. CLAIMS AND DISPUTS:

No supplement.

END OF SECTION

SECTION 01 1100-SUMMARY OF WORK

PART 1 GENERAL

1.1 PROJECT

A. Project Name: Apollo Renovations and Additions – Bid Package 2 REBID #2

B. Owner's Name: St. Cloud Area School District 742

C. Architect's Name: JLG Architects

D. Bid package two consists of bidding for the additions and renovation throughout the building facility

REVIEW SECTION 00 2413 CONTRACT BID CATEGORIES FOR SPECIFIC BID CATEGORIES.

1.2 CONTRACT DESCRIPTION

A. Contract Type: Multiple prime contracts

B. Each based on a Stipulated Price as indicated by the Construction Manager.

C. The work of each separate prime contract shall be identified by the Construction Manager.

1.3 PROJECT SCHEDULE FOR TIME OF COMPLETION

A. Project construction will be based on the following schedule:
   1. Bids Due: October 29th, 2026 at 2:00 PM
   2. School Board meeting / award contracts: November 4th, 2026
   3. Submittals/Front End Work to begin Immediately following award of contracts

B. Owner-caused delays in the schedule will adjust the schedule accordingly.

1.4 COMMENCEMENT OF WORK

A. Neither commence work, nor allow Subcontractors or Sub-subcontractors to commence Work until:
   1. Contract (AIA Document A132/CMa; Standard Form of Agreement Between Owner and Contractor; Construction Manager Edition) has been fully executed; or Owner / Construction Manager has issued a Notice to Proceed.
   2. Owner has approved Contractor's Performance Bond and Payment Bond (AIA A312), if required.
   3. Owner has approved evidence of Contractor's Liability Insurance, Owner's Protective Liability Insurance, and other required insurance to be purchased by the Contractor.

1.5 DESCRIPTION OF WORK

A. Scope of alterations work is shown on the drawings.

1.6 WORK BY OWNER

1.7 OWNER OCCUPANCY

A. School District 742 intends to occupy the Project upon Substantial Completion.

1.8 CONTRACTOR USE OF SITE

A. Arrange use of site and premises to allow:
   1. School District 742 occupancy.

2. Work by Others.
3. Work by School District 742.
4. Use of site and premises by the public.

B. Provide access to and from site as required by law and by School District 742:
   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.

C. Time Restrictions: As coordinated and directed by Construction Manager

D. Utility Outages and Shutdown:
   1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days' notice to School District 742 and authorities having jurisdiction.
   2. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

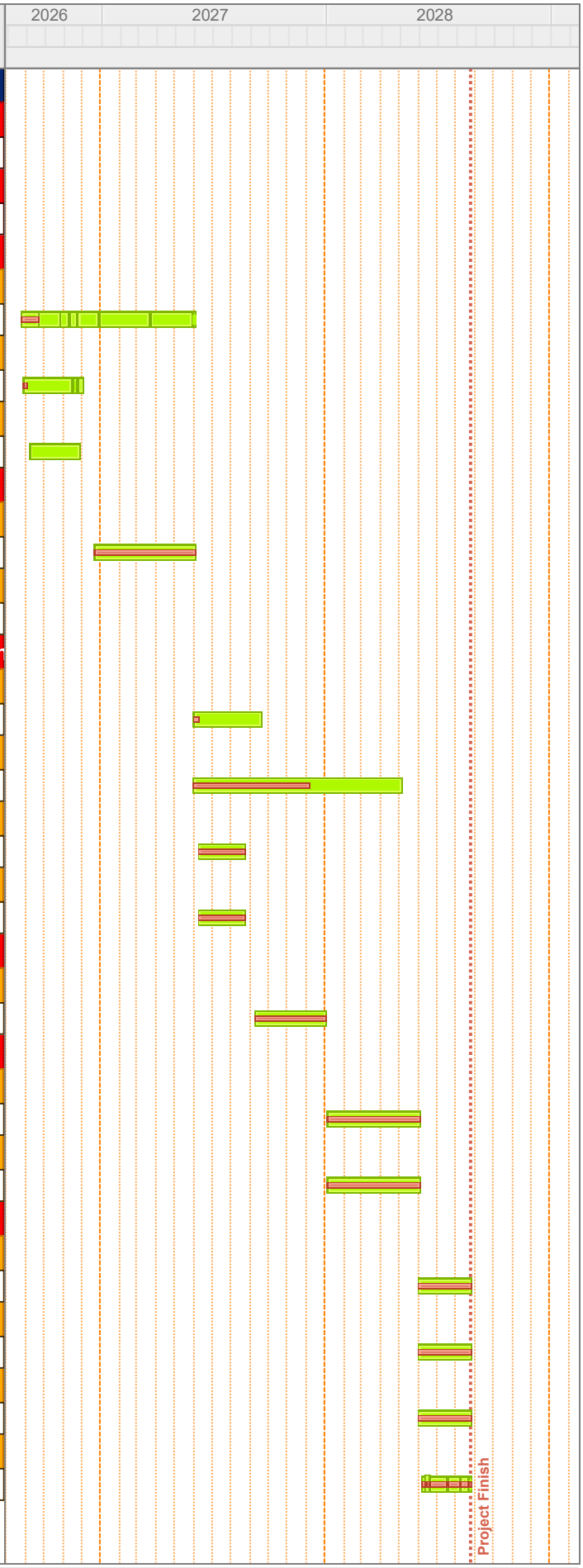
END OF SECTION

SECTION 01 1216 – WORK SCHEDULE

SEE ATTACHED CONSTRUCTION SCHEDULE

END OF SECTION

ID	Description	Start	Original Duration	Finish
Apollo Renovations and Additions				
Pre-Construction - Bid Package One			4 activities	
		11/20/25	20	12/22/25
Pre-Construction - Bid Package Two			1 activity	
		04/15/26	20	05/12/26
Phase One - Storm Shelter Addition and Int. Renovation				
Multipurpose Storm Shelter Addition			11 activities	
		08/24/26	201	05/31/27
Interior Renovations			12 activities	
		08/26/26	70	12/01/26
Weight Room			1 activity	
		09/07/26	59	11/26/26
Phase Two - Lockerroom & CTE Renovations				
Lockerroom and Pool Area			1 activity	
		12/21/26	116	05/31/27
CTE - B Wing			1 activity	
		11/20/25	160	07/01/26
Phase Three - Courtyard Infill, Admin Addition, and Receiving Addition				
Receiving and Storage Addition			8 activities	
		05/31/27	79	09/16/27
Admin Addition			11 activities	
		05/31/27	241	05/01/28
Science Renovations C2			1 activity	
		06/07/27	55	08/20/27
Interior Renovations - Fire Walls			1 activity	
		06/07/27	55	08/20/27
Phase Four - B Wing Interior Renovations				
Interior Renvoations - B / C1			1 activity	
		09/07/27	84	12/31/27
Phase 5 - C Wing Interior Renovations				
Interior Renovations - C1, C2, C3			1 activity	
		01/03/28	110	06/02/28
Kitchen Renovation - Prep Area			1 activity	
		01/03/28	110	06/02/28
Phase 6 - Athletics Addition, Kitchen, Band / Choir				
Kitchen Serving			1 activity	
		05/31/28	62	08/24/28
Band / Choir Renovations			1 activity	
		05/31/28	62	08/24/28
C2 Renovations			1 activity	
		05/31/28	60	08/22/28
Athletics Entry Addition			10 activities	
		06/05/28	59	08/24/28



Apollo Renovations and Additions - Bid Package Two
Project Specification Schedule

SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

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

C. Change procedures.

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

1.02 SCHEDULE OF VALUES

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

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

C. Submit Schedule of Values to the Architect at the earliest feasible date, but in no case later than seven days before the date scheduled for submittal of the initial application for payment.

D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section.
   1. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports.
   2. Break principle subcontract amounts down into several line items.
   3. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
   4. For each part of the Work where an Application for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
   5. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Application for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
   6. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

E. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
   1. Contractor's construction schedule.
   2. Application for Payment form.
   3. List of subcontractors.
   4. List of principal suppliers and fabricators.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

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

C. Execute certification by signature of authorized officer.

D. 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.

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

F. Submit three copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien, payroll reports, and/or similar attachments, when required.
   1. One approved copy will be retained by the Architect, one will be returned to the Contractor, and one forwarded to the Owner for their use in issuing payment.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
   1. List of subcontractors: AIA G705.
   2. List of principle suppliers and fabricators.
   3. Schedule of Values: AIA G703.
   4. Contractor's Construction Schedule (preliminary if not final).
   5. Schedule of principal products.
   6. List of Contractor's staff assignments.
   7. Certificates of insurance and insurance policies.
   8. Performance and payment bonds: AIA A312.

H. Include the following with each application:
   1. Waivers of Mechanics Lien: Submit waivers of mechanics lien from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, and related to the Work covered by the payment.
   2. Construction progress schedule, revised and current as specified in Section 01 3216.
   3. Affidavits attesting to off-site stored products.

I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
   1. Administrative actions and submittals that shall precede or coincide with this application include:
      a. Occupancy permits and similar approvals.
      b. Warranties (guarantees) and maintenance agreements.
      c. Testing, adjusting, and balancing reports.
      d. Maintenance instructions.
      e. Start-up performance reports.
      f. Change-over information related to Owner's occupancy, use, operation, and maintenance.
      g. Final cleaning.

h. Application for reduction of retainage, and consent of surety.
i. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

1.04 MODIFICATION PROCEDURES

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

B. Change Orders: 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 for executing the change and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.
1. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
a. Proposal requests issued by the Architect are for information only. Do not consider Proposal Requests as an instruction either to stop work in progress, or to execute the proposed change.
b. Unless otherwise indicated in the proposal request, within 5 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
c. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
d. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
e. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
2. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
a. Include a statement outlining the 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 Contract Time.
b. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
d. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of a product or system for a product or system specified.
3. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

C. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
2. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

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

D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. Maximum allowances for Subcontractor's/Contractor's overhead and profit as expressed as a percentage of the basic cost of the change:
   a. Subcontractors: 15% of the net cost of the additional Work.
   b. Contractors: 5% of the net cost of the additional Work performed by subcontractors.
   c. Contractors: 15% of the net cost of work performed by the contractor's own forces.
   d. Add 5% to above allowances for changes of less than $500.00.
   e. Deduct 5% from above allowances for changes greater than $10,000.00.
   f. Overhead and profit shall include all bond premiums (if applicable), and will not be allowed on labor costs if overhead and profit is already included in hourly billing rate.

E. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

F. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

G. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

H. Promptly enter changes in Project Record Documents.

1.05 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.

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 01 7000.
2. Completion of items specified for completion after Substantial Completion (punchlists).
3. Assurance that unsettled claims will be settled.
4. Assurance that Work not complete and accepted will be completed without undue delay..
5. Transmittal of required construction records to Owner.
6. Proof taxes, fees, and similar obligations have been paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2100 - ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash and material allowances.

B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CASH AND MATERIAL ALLOWANCES

A. Costs Included in Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts.

B. Architect Responsibilities:

1. Consult with Contractor for consideration and selection of products, suppliers .
2. Select products in consultation with St. Cloud School District 742 and transmit decision to Contractor.
3. Prepare Change Order.

C. Contractor Responsibilities:

1. Assist Architect in selection of products, suppliers , and installers.
2. Obtain proposals from suppliers and installers and offer recommendations.
3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

D. Differences in costs will be adjusted by Change Order.

1.04 ALLOWANCES SCHEDULE

A. **Section 09 9123 - Interior Painting**: Provide an allowance for $3,000 for repairing pocks in concrete columns. Final locations of repairs to be determined by Architect in field.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

C. Documentation of changes to Contract Sum and Contract Time.

1.02 DEFINITIONS

A. Alternate: An alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1.03 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at St. Cloud School District 742'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. Work Included Under Each Alternate: Make modifications to work required by each alternate selected at no additional cost to the Owner other than as proposed on the Bid Form. Bidders shall be responsible for alternates and shall see that all changes are covered under their related sections, whether specifically called out or not. Extra costs incurred due to modifications to or deviations from the Drawings or Specifications caused directly or indirectly by each alternate shall be included in each alternate bid.

1.04 SCHEDULE OF ALTERNATES

A. **Alternate No. 1**: Wayfinding Signage.

1. State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required for providing Wayfinding Signage (SIGN-11A) and all power required for signs, as indicated in the civil drawings and detailed on the architectural drawings.
   Base Bid: No exterior Wayfinding Signage.

B. **Alternate No. 2**: Wayfinding Signage.

1. State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required for providing Wayfinding Signage (SIGN-11B) and all power required for signs, as indicated in the civil drawings and detailed on the architectural drawings.
   Base Bid: No exterior Wayfinding Signage.

C. **Alternate No. 3**: Kitchen and Serving Flooring.

1. State the amount to be ADDED to or DEDUCTED from the Base Bid to provide all materials, labor & equipment required for providing (VSF-1) and (VSFB-1) flooring in lieu of scheduled flooring in kitchen and serving, as indicated in the drawings and specifications.
   Base Bid: Provide floor finish in kitchen and serving, as indicated on drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 00 2600 - Procurement Substitution Procedures: Required form for substitutions requests made before the end of bidding (during procurement).

B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 REFERENCE STANDARDS

A. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

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 provide same or equivalent maintenance service and source of replacement parts, as applicable.
4. 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 St. Cloud School District 742.
5. Waives claims for additional costs or time extension that may subsequently become apparent.
6. Agrees to reimburse St. Cloud School District 742 and Architect for review or redesign services associated with re-approval by authorities.

B. Where a product requirement includes sustainability documentation, this documentation is required to to be included in the substitution request. If documentation is not included, the substitution will be rejected. See individual Specification Sections sustainability requirements.

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

D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

1. Forms included in the Project Manual are adequate for this purpose, and must be used.

E. 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. Section 00 2600 - Procurement Substitution Procedures specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
   1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Architect will consider requests for substitutions only within 30 days after date of Agreement. Requests for substitutions after the bids have been received are done so at the risk of the Contractor. Substitutions may not be granted.

C. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

D. 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. When acceptance will require revisions to Contract Documents.

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.

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 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Submittals for review, information, and project closeout.
C. Number of copies of submittals.
D. Requests for Information (RFI) procedures.
E. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: General product requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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 St. Cloud School District 742.
   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 6000 - 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.
    a. The St. Cloud School District 742 reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

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. St. Cloud School District 742'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. 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 St. Cloud School District 742.
1. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

3.02 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.

1. Coordinate with Contractor's construction schedule and schedule of values.
2. Format schedule to allow tracking of status of submittals throughout duration of construction.
3. 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, and role and name of subcontractor.
4. 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.

3.03 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.
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 and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.04 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. Other types indicated.
B. Submit for Architect's knowledge as contract administrator or for St. Cloud School District 742.

3.05 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 7800 - Closeout Submittals:
    1. Project record documents.
    2. Operation and maintenance data.
    3. Warranties.
    4. Bonds.
    5. Other types as indicated.
D. Submit for St. Cloud School District 742's benefit during and after project completion.

3.06 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.

3.07 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item.
   2. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   3. 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. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   4. Deliver each submittal 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.
   5. 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.
      b. For sequential reviews involving Architect's consultants, St. Cloud School District 742, or another affected party, allow an additional 7 days.
      c. Color selections will not be reviewed or approved until all related products are submitted to ensure a cohesive palette.
      d. Products that make up a system, assembly, or that are directly related to each other often must be reviewed together. Review will not begin until all components are submitted.
      e. Coordinate with Architect and/or Construction Manager, as applicable, where schedule dictates an expedited review of products.
   6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   7. Provide space for Contractor and Architect review stamps.
   8. When revised for resubmission, identify all changes made since previous submission.
   9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
   10. 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.

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.

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.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

E. Do not use shop drawings without an appropriate final stamp indicating action taken in connection with construction.

3.08 SUBMITTAL REVIEW

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

B. Submittals for Information: Architect will acknowledge receipt and review.

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

END OF SECTION

SECTION 01 3329 - SUSTAINABILITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements to implement sustainable design intent.

1.02 MEETINGS

A. Include these requirements on kick-off meeting and progress meeting agendas.

1.03 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: General submittal requirements.

B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. Section 01 7419 - Construction Waste Management and Disposal.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for additional submittal procedures requirements.

B. Submit documentation specified in this Section and in applicable individual Sections.

C. One or more of the following documents shall be submitted when indicated in individual Sections:

1. Environmental Product Declarations (EPD).
2. Health Product Declarations (HPD).
3. Declare product labels showing Red List Free or Red List Approved.
4. Forest Stewardship Council (FSC).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. References and standards.
C. Testing and inspection agencies and services.
D. Control of installation.
E. Mock-ups.
F. Tolerances.
G. Manufacturers' field services.
H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.
B. Section 01 6000 - Product Requirements: Requirements for material and product quality.
C. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

1.03 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
B. Base design on performance and/or design criteria indicated in individual specification sections.
C. Scope of Contractor's Professional Design Services: Provide for the following items of work:

1.04 SUBMITTALS

A. See Section 01 3000 - 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 St. Cloud School District 742's information.
C. Test Reports: After each test/inspection, promptly submit two copies 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.

2. Test report submittals are 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 St. Cloud School District 742's information.

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 St. Cloud School District 742'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 St. Cloud School District 742.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for St. Cloud School District 742.
   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 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.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

A. St. Cloud School District 742 will employ and pay for services of an independent testing agency to perform other specified testing.

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

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 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.

3.03 TESTING AND INSPECTION

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

B. See Section 01 9115 - Facility Exterior Enclosure Commissioning and BECx Plan.

C. Testing Agency Duties:

1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests/inspections specified.
9. Submit a written report in binder form with an index at the conclusion of the work required by the Testing Agency. The report shall be submitted as a permanent record to the Owner, through the Structural Engineer, of all tests, logs, comments and written reports.

D. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

E. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide delivery of samples to testing laboratories.
      e. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Each Prime Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
   6. Each Prime Contractor and each agency engaged to perform inspections, tests, and similar services shall coordinate the sequence of activities to accommodate required services with minimal delay.
   7. Each Prime Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
   8. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   9. Arrange with St. Cloud School District 742's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

F. Re-testing: The Contractor is responsible for re-testing where results of required inspections, tests, or similar services prove unsatisfactory or do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

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

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

I. The Contractor shall cooperate with agencies performing required inspections, tests, and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel.

3.04 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. Submit qualifications of observer to Architect 30 days in advance of required observations.
   1. Observer subject to approval of Architect.
   2. Observer subject to approval of St. Cloud School District 742.

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

3.05 DEFECT ASSESSMENT

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

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

Minnesota Department of Labor and Industry
Construction Codes and Licensing Division
Building Plan Review/Inspections
443 Lafayette Road North
St. Paul, MN 55155
Phone: (651) 284-5068
Fax: (651) 284-5749
www.dli.mn.gov

DEPARTMENT OF LABOR AND INDUSTRY

Special Inspections and Testing Program
Summary Schedule

Reset

PRINT IN INK or TYPE your responses.

PROJECT NAME	PROJECT NO.
Apollo High School Renovations and Additions BP2	
LOCATION	PERMIT NO.
1000 44th Ave N, St. Cloud, MN 56303	

Technical (2)		Description (3)	Type of Inspector (4)	Specific Report Frequency (5)	Assigned Firm (6)
Section	Article				
IBC T.1704.2.5		Shop Fabricated Items (Precast)	SI-S	Upon Completion	
IBC T. 1705.2.1		Steel	SI-T	Weekly	
IBC T. 1705.3		Concrete	SI-S	Daily	
IBC T1705.6		Earthwork	SI-T	Daily	
IBC T. 1705.17		Fire Resistive Penetrations and Joints	SI-T	Upon Completion	
ICC 500	106.4	and at completion of opening protection installation	SER	Per inspection	Origin Design
		and at completion of opening protection installation			
ICC 500	107.3.1 & .2	Wall connections to roof diaphragm and framing	SI-S	Per inspection	
ICC 500	107.3.1 & .2	Precast shear wall connections between panels and to the foundations	SI-S	Per inspection	
ICC 500	107.3.1 & .2	Fabrication and installation of opening protection shrouds	SI-S	Per inspection	
ICC 500	107.3.1 & .2	Installation of impact door and window frames	SI-S	Per inspection	
ICC 500	107.3.1 & .2	Fabrication and installation of opening embedded plates	SI-S	Per inspection	

Note: **This schedule shall be filled out and included in a Special Structural Testing and Inspection Program.**
(If not otherwise specified, assumed program will be "Guidelines for Special Inspection & Testing" as contained in the State Building Code and as modified by the state adopted IBC.)
A complete specification-ready program can be downloaded directly by visiting CASE/MN at www.cecm.org

(1) Permit No. to be provided by the Building Official
(2) Referenced to the specific technical scope section in the program.
(3) Use descriptions per IBC Chap 17, as adopted by MN State Bldg Code.
(4) Special Inspector – Technical (SIT); Special Inspector – Structural (SIS)
(5) Weekly, monthly, per test/inspection, per floor, etc.
(6) Name of Firm contracted to perform services.

ACKNOWLEDGEMENTS (Each appropriate representative shall sign below)

Owner:		Firm:		Date:	
Contractor:		Firm:		Date:	
Architect:		Firm:		Date:	
SER:	Eric Helminiak	Firm:	Origin Design	Date:	3/25/2026
SI-T		Firm:		Date:	
SI-S:		Firm:		Date:	
TA:		Firm:		Date:	
F:		Firm:		Date:	

If requested by engineer/architect of record or building official, the individual names of all prospective special inspectors and the work they intend to observe shall be identified as an attachment.

Legend: SER = Structural Engineer of Record SI-T = Special Inspector - Technical TA = Testing Agency SI-S = Special Inspector - Structural F = Fabricator

Accepted for the Building Department By_____Date_____

This material can be made available in different forms, such as large print, Braille or on a tape. To request, call 1-800-342-5354 (DIAL-DLI) Voice or TDD (651) 297-4198.

SECTION 01 4533 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.
B. Testing services incidental to special inspections.
C. Submittals.
D. Manufacturers' field services.
E. Fabricators' field services.

1.02 DEFINITIONS

A. Code or Building Code: ICC (IBC), International Building Code, most recent edition adopted by authority having jurisdiction, including all applicable amendments and supplements without limitation, and specifically Chapter 17 - Special Inspections and Tests.
B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
C. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.
    1. Special inspections and tests are separate from and independent of tests and inspections conducted by St. Cloud School District 742 or Contractor for purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS

A. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.
B. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2025.
C. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Special Inspection Agency Qualifications: Prior to start of work, Special Inspection Agency is required to:
    1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
    2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
    3. Submit certification that Special Inspection Agency is acceptable to AHJ.
    4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
C. Testing Agency Qualifications: Prior to start of work, Testing Agency is required to:
    1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
    2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

3. Submit certification that Testing Agency is acceptable to AHJ.
4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.

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

E. Test Reports: After each test or inspection, Testing Agency is required to submit report to Architect and to AHJ.
   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 or inspection.
      h. Date of test or inspection.
      i. Results of test or inspection.
      j. Compliance with contract documents.

F. Certificates: When required by AHJ, Special Inspector will submit certification by manufacturer, fabricator, and installation subcontractor to Architect and AHJ.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.

G. Fabricator's Inspection Reports: When required by AHJ, submit reports to Architect and AHJ.
   1. Submit report in duplicate within 30 days of observation to Architect for information.

1.05 SPECIAL INSPECTION AND TESTING AGENCY

A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.06 TESTING AND INSPECTION AGENCIES

A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.07 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:

1. Independent firm specializing in performing testing and inspections of the type specified in this section.

B. Testing Agency Qualifications:

1. Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.

1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reinforcement, Including Prestressing Tendons, and Verification of Placement: Verify compliance with ACI CODE-318, Chapters 20, 25.2, 25.3, 26.6.1-26.6.3; periodic.

B. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI CODE-318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.

C. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI CODE-318.

1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.

D. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI CODE-318, Chapter 19, 16.4.3, 26.4.4; periodic.

E. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M, and ACI CODE-318, Chapter 26.5, 26.12, and record the following, continuous:

1. Slump.
2. Air content.
3. Temperature of concrete.

F. Specified Curing Temperature and Techniques: Verify compliance with ACI CODE-318, Chapter 26.5.3 through 26.5.5; periodic.

G. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI CODE-318, the AHJ will require testing of materials in accordance with the appropriate standards and criteria in ACI CODE-318, Chapters 19 and 20.

3.03 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
   1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified reference standards.
   4. Ascertain compliance of materials and products with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Attend preconstruction meetings and progress meetings.
   8. Submit reports of all tests or inspections specified.

B. Limits on Special Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.

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

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

3.04 TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Testing Agency Duties:
   1. Test samples submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Attend preconstruction meetings and progress meetings.
   8. Submit reports of all tests or inspections specified.

B. Limits on Testing or Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.

C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.

D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.05 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:

1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to work to be tested or inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
    c. To facilitate tests or inspections.
    d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with St. Cloud School District 742's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

3.06 FABRICATORS' FIELD SERVICES

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

B. Submit qualifications of observer to Architect 30 days in advance of required observations.

1. Observer subject to approval of Architect.
2. Observer subject to approval of St. Cloud School District 742.

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

END OF SECTION

SECTION 01 4600 - CONTRACTOR STATEMENT OF RESPONSIBILITY

PART 1 GENERAL

1.01 CONTRACTOR STATEMENT OF RESPONSIBILITY

A. See attached form for the Contractor Statement of Responsibility to be completed for the Storm Shelter requirements. See Bid Scopes for scopes and/or Contractor's required to submit statement.

Contractor Statement of Responsibility

Project Name: _____
Project Number:_____

Type of Shelter: _____

Quality Assurance Plan Categories Received *(please indicate all QA Plans this statement is for)*:

☐ Roof cladding, soffits, and roof framing connections.
☐ Wall connections to roof and floor diaphragms and framing.
☐ Roof and floor diaphragm systems, including connectors, drag struts and boundary elements.
☐ Main windforce-resisting systems, including braced frames, moment frames and shear walls.
☐ Main windforce-resisting system connections to the foundation.
☐ Fabrication and installation of components and assemblies meeting missile impact test requirements
☐ Wall cladding and wall cladding connections.
☐ Corrosion resistance or protection of exposed metal connectors providing load path continuity.
☐ Critical support systems and connections and debris impact protection
☐ Foundation design.
☐ Prefabricated shelter installation requirements
☐ Prefabricated shelter minimum foundation capacity requirements.

Please list procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of reports. Please identify and list qualifications of the person(s) exercising such control and their position(s) in the organization.

I acknowledge the special requirements contained in the quality assurance plan. I acknowledge that control will be exercised to obtain compliance with the construction documents. I acknowledge that the procedures for exercise control within my organization(s) and the individuals and qualifications of the person(s) exercising such control listed above are accurate to the best of my knowledge.

_____

(PRINTED NAME)

_____

(SIGNATURE) *(DATE)*

SECTION 01 6000 - 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 St. Cloud School District 742-supplied products.
G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 00 2600 - Procurement Substitution Requirements: Requests for substitution during the bidding process.
B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
C. Section 01 4000 - Quality Requirements: Product quality monitoring.
D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
E. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
    1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," " equipment," "system," and terms of similar intent.
    2. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
    3. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.
    4. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.04 REFERENCE STANDARDS

A. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products; 2022 (Corrigendum 2021).
B. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.
C. ISO 14040 - Environmental Management - Life Cycle Assessment - Principles and Framework; 2006, with Amendment (2020).

D. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines; 2006, with Amendment (2020).

E. ISO 21930 - Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services; 2017.

1.05 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 30 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. 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.

C. 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.

D. 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.

E. Sustainable Design Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.06 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
   1. Each prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate Contractors.
   2. If a dispute arises between prime Contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
   1. Name of product and manufacturer.
   2. Model and serial number.
   3. Capacity.
   4. Speed.

5. Ratings.

F. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
   1. Good: Product-specific; compliant with ISO 14044.
   2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
   3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
   4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.

G. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.

H. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber sourced and labeled by an organization accredited by one of the following:
   1. Wood sourced from a sustainable harvested location. Submit any documentation available.
   2. Chain of Custody documents are not required.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
   1. Provide products complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
   1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
   2. Semi proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
      a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Documents provisions concerning "substitutions" to obtain approval for use of an unnamed product.
   3. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
   4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are

recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

5. Compliance with Standards, Codes, and Regulations: Where the Specifications only require compliance with an imposed code, standard, or regulation select a product that complies with the standards, codes, or regulations specified.
6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
7. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

2.02 EXISTING PRODUCTS

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

B. Unforeseen historic items encountered remain the property of the St. Cloud School District 742; notify St. Cloud School District 742 promptly upon discovery; protect, remove, handle, and store as directed by St. Cloud School District 742.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the St. Cloud School District 742, or otherwise indicated as to remain the property of the St. Cloud School District 742, become the property of the Contractor; remove from site.

2.03 NEW PRODUCTS

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

B. Use of products having any of the following characteristics is not permitted:

1. Made using or containing CFC's or HCFC's.
2. Made of wood from newly cut old growth timber.
3. Containing lead, cadmium, or asbestos.

C. 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 6116.
2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
3. Are extracted, harvested, and/or manufactured closer to the location of the project.
4. Have longer documented life span under normal use.
5. Result in less construction waste. See Section 01 7419
6. Are made of vegetable materials that are rapidly renewable.
7. Are made of recycled materials.
8. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
9. Have a published Environmental Product Declaration (EPD).
10. Have a published Health Product Declaration (HPD).
11. Are Living Building Challenge Red List Free.
12. Have a published Declare Label.

2.04 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.

2.05 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 2500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. St. Cloud School District 742's Responsibilities:

1. Arrange for and deliver St. Cloud School District 742 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.

B. Contractor's Responsibilities:

1. Review St. Cloud School District 742 reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with St. Cloud School District 742.
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. 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 7419.

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

C. Store with seals and labels intact and legible.

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

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

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

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

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

I. Do not store products directly on the ground.

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

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

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

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

3.05 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01 6116 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Flooring.
4. Composite wood.
5. Products making up wall and ceiling assemblies.
6. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Wet-applied roofing and waterproofing.
4. Other products when specifically stated in the specifications.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:

1. Concrete.
2. Clay brick.
3. Metals that are plated, anodized, or powder-coated.
4. Glass.
5. Ceramics.
6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; Current Edition.

E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

F. CHPS (HPPD) - High Performance Products Database; Current Edition.

G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

H. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J. SCS (CPD) - SCS Certified Products; Current Edition.

K. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.

1. Wet-Applied Products: State amount applied in mass per surface area.
2. Paints and Coatings: Test tinted products, not just tinting bases.
3. Evidence of Compliance: Acceptable types of evidence are the following;
    a. Current UL (GGG) certification.
    b. Current SCS (CPD) Floorscore certification.
    c. Current SCS (CPD) Indoor Advantage Gold certification.
    d. Current listing in CHPS (HPPD) as a low-emitting product.
    e. Current CRI (GLP) certification.
    f. Test report showing compliance and stating exposure scenario used.
4. Product data submittal showing VOC content is NOT acceptable evidence.
5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.

1. Evidence of Compliance: Acceptable types of evidence are:
    a. Report of laboratory testing performed in accordance with requirements.
    b. Published product data showing compliance with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
b. Report of laboratory testing performed in accordance with requirements.
c. Published product data showing compliance with requirements.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
2. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
2. Joint Sealants: SCAQMD 1168 Rule.
3. Paints and Coatings: Each color; most stringent of the following:
a. 40 CFR 59, Subpart D.
b. SCAQMD 1113 Rule.
c. CARB (SCM).
4. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. St. Cloud School District 742 reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to St. Cloud School District 742.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 7000 - 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. Cutting and patching.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of St. Cloud School District 742 personnel.

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

H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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 St. Cloud School District 742 or separate Contractor.

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

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.

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

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

1.06 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.

B. 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.

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

D. 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.

E. 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.

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

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

H. After St. Cloud School District 742 occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of St. Cloud School District 742'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 6000 - 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, St. Cloud School District 742, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Promptly notify Architect of any discrepancies discovered.

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. 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.
C. 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.

D. 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. See Section 01 1000 for other limitations on outages and required notifications.
      c. 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.

E. 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.

F. 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. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
   4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

G. 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.

H. 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.

I. Clean existing systems and equipment.

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

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

L. 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 skilled and experienced 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 8400, 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. 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.

G. 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. Notify Architect and Owner seven days prior to start-up of each item.

C. 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.

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

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

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

G. 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.

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

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to St. Cloud School District 742's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with St. Cloud School District 742's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.12 ADJUSTING

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

3.13 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. 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.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
E. Clean filters of operating equipment.
F. Clean debris from roofs and drainage systems.
G. Clean site; sweep paved areas, rake clean landscaped surfaces.
H. 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.
B. Accompany Project Coordinator 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. 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.
F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to St. Cloud School District 742-occupied areas.
G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
H. 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 St. Cloud School District 742.

END OF SECTION

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. St. Cloud School District 742 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: May be used as blocking or furring.
5. 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. 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.

F. 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 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for St. Cloud School District 742.

B. Section 01 2500 - Substitution Procedures.

C. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

D. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

E. Section 01 6000 - Product Requirements: Waste prevention requirements related to product substitutions.

F. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

G. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

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 3000 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 01 6000 and Section 01 2500.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:

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 Sum.
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 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

C. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

END OF SECTION

SECTION 01 7800 - 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 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
B. Section 01 7000 - 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 two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
    2. For equipment, or component parts of equipment put into service during construction and operated by St. Cloud School District 742, submit completed documents within ten days after acceptance.
    3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
    4. Submit two sets of revised final documents in final form within 10 days after final inspection.
C. Warranties and Bonds:
    1. For equipment or component parts of equipment put into service during construction with St. Cloud School District 742'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 St. Cloud School District 742.

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 Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.

3.02 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.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

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. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. 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.

3.04 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. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. 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. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. 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.

F. 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.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for St. Cloud School District 742's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. 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.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. 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.

G. 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.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. 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.
4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.06 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 St. Cloud School District 742'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. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

F. 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.

G. 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.

H. 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.

END OF SECTION

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BUILDING ENCLOSURE COMMISSIONING PLAN

FOR THE

St. Cloud Area School District 742
Apollo High School – Building Addition

Building Enclosure Commissioning Plan Overview

The purpose of the Building Enclosure Commissioning (BECx) Plan is to provide a clear and concise roadmap for the implementation of the building enclosure commissioning process and to provide a record of the results of the building enclosure commissioning process. Since the Building Enclosure Commissioning Plan contains the results of the process, it can be considered a living document where the results are added throughout the process. Therefore, to simplify the upkeep of the document, the basic process and procedures to be followed throughout the project are detailed in the main body of the Building Enclosure Commissioning Plan. The materials and information that are developed during the building enclosure commissioning process are included in the appendices.

Systems to Be Commissioned

The systems and materials to be commissioned are outlined in the table below. Systems and materials apply only as appropriate to the materials, components, and systems specified in each building enclosure Technical Sections (Divisions 03-09).

Systems to Be Commissioned					
System	**Field Checklists**	**Equipment Startup**	**Performance Testing**	**Sampling Rate**	**Remarks**
Div 3 - Concrete					
CIP Concrete Foundations	Yes	NA	No	NA	NA
Below Slab Insulation/VR	Yes	NA	No	NA	NA
Precast Architectural Concrete	Yes	NA	Yes	NA	NA
Div 4 – Masonry					
Unit Masonry	NA	NA	No	NA	NA
Div 6 – Wood, Plastics, and Composites					
Exterior Sheathing	Yes	NA	No	NA	NA
Div 7 - Thermal and Moisture Protection					
Roofing	Yes	NA	No	N/A	NA
Waterproofing	Yes	NA	No	N/A	NA
Coatings	Yes	NA	No	N/A	NA
Thermal Insulation (at exterior walls only)	Yes	NA	No	N/A	NA
Air and Vapor Barriers	Yes	NA	No	TBD	NA
Metal Wall Panels	Yes	NA	No	TBD	NA
Insulated Metal Wall Panels	NA	NA	No	TBD	NA
Joint Sealants (at building enclosure only)	Yes	NA	Yes	TBD	NA

System	Field Checklists	Equipment Startup	Performance Testing	Sampling Rate	Remarks
Flashings	Yes	NA	No	TBD	NA
Exterior Expansion Joints	Yes	NA	No	N/A	NA
Div 8 – Openings					
Doors, Frames, and Thresholds	Yes	NA	Yes	TBD	NA
Aluminum-Framed Entrances and Storefronts	Yes	NA	Yes	TBD	NA
Glazed Aluminum Curtain Walls	NA	NA	No	TBD	NA
Glazing	Yes	NA	No	NA	NA

Building Enclosure Commissioning Communications and Document Distribution

The following table outlines the submittal and distribution requirements for various documents used in the building enclosure commissioning process.

Communication Distribution Matrix

Document	Prepared by:	Submitted to:	Copies to:	Comments
Owner's Project Requirements	Owner	• A/E • BECxP		
Constructability Review	BECxP	• Owner • A/E		Provide review comments related to the durability, performance and building enclosure conformance with the Owner's Project Requirements and is for consideration by the Owner, A/E, and Contractor.
Building Enclosure Commissioning Specification	BECxP	• A/E	• Owner	Specification format provided by A/E and edited by BECxP
Building Enclosure Commissioning Plan	BECxP	• Owner	• A/E	
Design Development Documents Review Comments	BECxP	• Owner	• A/E	Provide review comments on the DD documents related to the building enclosure for compliance with the Owner's Project Requirements for consideration by the Owner, A/E, and Contractor.

Communication Distribution Matrix				
Document	**Prepared by:**	**Submitted to:**	**Copies to:**	**Comments**
Construction Documents Review Comments	BECxP	• Owner • A/E		Provide review comments on the construction documents related to the building enclosure for compliance with the Owner's Project Requirements for consideration by the Owner, A/E, and Contractor.
Submittals and Shop Drawings on Commissioned Systems	CM	• BECxP • A/E		Submittals and shop Drawings are submitted to the A/E as separate submission.
Factory/Laboratory, Test Agency, and Inspection Reports	CM	• BECxP		Provide as required by the specifications. Reports are submitted to the A/E as separate submission.
Schedule Updates	CM	• BECxP		Periodic updates to the construction schedule to notify BECx team of scheduled tests, meetings, and milestone installation events.
Submittal and Shop Drawing Review Comments	BECxP	• Owner • A/E • CM		Provide review comments on submittals and shop drawings related to the building enclosure for consideration by the Owner, A/E, and Contractor.

Communication Distribution Matrix

Document	Prepared by:	Submitted to:	Copies to:	Comments
BECx Preconstruction Commissioning Conference Meeting Minutes	BECxP	• Owner • A/E • CM		Record and distribute meeting minutes.
Mock-Up Summary Report	BECxP	• Owner • A/E • CM		Attend the construction and testing of project-specific mock-ups and provide written summary report.
Action List Log	BECxP	• Owner • A/E • CM		A list that is maintained and updated by the BECxP that includes all action items that relate to BECx activities, including a summary of description of each action item, date, responsible party, date and summary of corrective action.
Action Item Response	CM	• BECxP	• Owner • A/E	Contractor response to action items to which BECx team members assign the Contractor responsibility.
Action Item Response	A/E	• BECxP • CM	• Owner	Provide resolution to action items for which the BECxP and Contractor may be in disagreement.
Field Checklists	CM	• A/E • BECxP		Field checklists for building enclosure assemblies.
Maintenance and Warranty Information	CM	• BECxP	• A/E Team	Sources of material, maintenance data, and warranty information for products, assemblies, and components related to the building enclosure as required by the

Communication Distribution Matrix				
Document	**Prepared by:**	**Submitted to:**	**Copies to:**	**Comments**
				specifications.
Maintenance Schedule Summary Table	CM	• BECxP	• Owner • A/E	Summary table indexing the building enclosure component requiring maintenance and the frequency for required repair/ replacement.
Building Enclosure Commissioning Report	BECxP	• CxP / Owner		Compile test data, inspection reports, and certificates for inclusion in the final Commissioning Report.
Record Drawings, Specifications, Approved Product Data and Shop Drawings, and As-Built set of final drawings	CM	• BECxP		Provide as required by the specifications.
Building Enclosure Commissioning Record	BECxP	• Owner	• A/E	Provide complete commissioning records at the discretion of the Owner.

BUILDING ENCLOSURE COMMISSIONING TEAM ROLES AND RESPONSIBILITIES

Building Enclosure Commissioning Team Roles and Responsibilities				
Project Phrase	**BECx Task**	**Description**	**Team Member**	**Responsibility**
Pre-Design	Building Enclosure Commissioning Plan	Develop construction phase Building Enclosure Commissioning Plan to identify specific systems to be commissioned. The Building Enclosure Commissioning Plan will also include specific individual roles and responsibilities.	Owner	• Review and approve Building Enclosure Commissioning Plan and Specification. • Distribute BECxP to CM & A/E • Provide comments to BECxP. • Distribute comments from CM & A/E back to BECxP
			CM	• Review BECx Plan relative to CM and installing sub-contractor's roles and responsibilities. • Review building enclosure technical specifications, identify required BECx items, and provide a schedule to the BECxP with anticipated dates for each item. • Provide comments to BECxP.
			BECxP	• Prepare Building Enclosure Commissioning Plan. • Issue to Owner. • Incorporate comments into BECx Plan revisions as necessary.
			A/E	• Review BECx Plan relative to Design Team roles and responsibilities. • Provide comments to Owner.
Design	BECxP - DD		A/E and BECxP	• Review SD, DD, and CD phase. • DD BECx specifications and recommended tests. • Compatibility documentation of components.

Building Enclosure Commissioning Team Roles and Responsibilities				
Project Phrase	**BECx Task**	**Description**	**Team Member**	**Responsibility**
Pre-Construction	Submittal and Shop Drawing Review	Review product data, sample, and shop drawing submittals for compliance with the design intent and Owner's Project Requirements.	CM	• Provide submittals related to the building enclosure to the BECxP for their review, including shop drawings, product data, factory/laboratory test reports, samples, substitution requests, and change notifications pertaining to building enclosure. • Incorporate BECx activities into the master construction schedule.
			BECxP	• Review and provide comment on shop drawings, product data, factory/laboratory test reports, samples, substitution requests, and change notifications pertaining to building enclosure for compliance with the design intent and Owner's Project Requirements. Provide comments to A/E for consideration in their review of the submittals.
			A/E	• Review, comment, and approve/disapprove BECxP review comments.
Pre-Construction	Pre-Construction Commissioning Conference meeting	Conduct an initial commissioning meeting with the Owner, A/E, and Contractors. The purpose of the meeting will be to establish the purpose and proposed process for commissioning this facility in the construction, acceptance and warranties phases of the project. Review the individual roles and responsibilities of each participating commissioning team member as specified in the Construction Documents	Owner	• Review building enclosure commissioning schedule data. • Coordinate with Contractors to incorporate building enclosure commissioning activities into project schedule. • Attend pre-construction commissioning conference.
			BECxP	• Coordinate and Chair pre-construction commissioning conference. Review commissioning responsibilities and personnel assignments and discuss items of significance that could affect progress as required by the specifications. • Record and distribute meeting minutes.

Building Enclosure Commissioning Team Roles and Responsibilities				
Project Phrase	**BECx Task**	**Description**	**Team Member**	**Responsibility**
			A/E	Attend pre-construction commissioning conference.
			CM	• Provide summary and schedule of laboratory and field quality control tests and inspections required by the Contract Documents to BECxP. Keep BECxP updated if there are any changes to the schedule as it will take 2 – 3 weeks advance notice to schedule testing. • Incorporate building enclosure commissioning activities into Master Construction Schedule. • Attend pre-construction commissioning conference.
Pre-Construction	Mock-Up construction and testing	Not to be completed	CM	
			BECx P	
			Owner A/E	

Building Enclosure Commissioning Team Roles and Responsibilities				
Project Phrase	**BECx Task**	**Description**	**Team Member**	**Responsibility**
Pre-Construction	Field Checklists	Prepare Field Checklists for systems, components and/or building enclosure materials to be commissioned. These Field Checklists will be used for quality control and to document the completion of system, component and material installation. Completed Field Checklists are to be submitted to the building enclosure commissioning agent and A/E.	BECxP	• Review checklists. • Provide comments to CM.
			CM	• Develop and maintain field checklists for building enclosure activities. • Issue to BECxP and A/E for review. • Incorporate changes into final checklists as necessary.
			A/E	• Review checklists. • Provide comments to CM.
Construction	Building enclosure system and component testing	Performance testing of installed building enclosure systems, components, and materials will be completed as specified in the building enclosure commissioning specifications and project technical specification sections (Divisions 03 through 09). The objective of performance testing is to demonstrate that each building enclosure system, and system-to-system interfaces meet	Owner A/E	• Participate in field testing coordination meetings. • Attend the field testing to observe progress at their discretion.
			BECxP	• Participate in field testing coordination meetings. • Perform periodic site visits to document that work is being performed in compliance with the project specifications. • Outline the commissioning process and performance test procedures. • Witness and document building enclosure field testing.

Building Enclosure Commissioning Team Roles and Responsibilities				
Project Phrase	**BECx Task**	**Description**	**Team Member**	**Responsibility**
		or exceed the performance requirements of the contract documents and the building enclosure design intent.	CM	• Participate in field testing coordination meetings. • Coordinate with the BECxP construction testing and submit field quality control testing, field checklists and inspection reports on building enclosure construction to BECxP. • Perform out of sequence work as required to facilitate field tests. • Coordinate corrective action of components that do not pass performance testing.
Construction	Construction Observation	Conduct visits to the construction site to observe construction activities related to building enclosure components and systems general conformance with the contract documents, building enclosure design intent, and the manufacturer's installation requirements.	Owner	• Review Action List.
			BECxP	• Conduct periodic Construction Observation visits to observe construction progress, system/component installation and general quality of construction. • Witness milestone installations and conduct visits no less than weekly during construction of the building enclosure. • Identify Action Items that requires a response, completion, corrective action, or additional work related to the building enclosure construction. • Assign Action Items to the proper party for remedial action. • Maintain and update Action List log that includes all action items related to BECx activities, including a summary of description of each action item, date, responsible party, date and summary of corrective action. • Monitor and verify corrective actions.

Building Enclosure Commissioning Team Roles and Responsibilities				
Project Phrase	**BECx Task**	**Description**	**Team Member**	**Responsibility**
			A/E	• Review Action List. • Provide responses to items as needed.
			CM	• Coordinate and Chair construction-phase coordination meetings. • Review and respond to Action Items in a timely manner. • Provide corrective actions as directed by the Action Log to resolve outstanding issues. • Issue periodic updates to the construction schedule every two weeks or less as appropriate. Schedule shall be used to notify BECx team of scheduled tests and milestone installation events. • Maintain at the site an updated set of record or "As-Built" documents reflecting actual installed conditions and all approved changes and modifications to the contract documents. Access shall be provided to the BECxA to review the "As-Built" and record documents. The record documents shall be maintained concurrently with construction.
Construction	Building Enclosure Commissioning Meetings	Routine meetings to review progress, status, and resolve items on the Action List. Meetings should be conducted no less than every month during construction of the building enclosure.	Owner	• Attend building enclosure commissioning meetings. • Provide final interpretative authority on disputed deficiencies.
			BECxP	• Conduct routine meetings. • Review progress on the Action List and resolve issues affecting the building enclosure.

Building Enclosure Commissioning Team Roles and Responsibilities				
Project Phrase	**BECx Task**	**Description**	**Team Member**	**Responsibility**
				• Maintain and update Action List log that includes all action items related to BECx activities, including a summary of description of each action item, date, responsible party, date and summary of corrective action.
			A/E	• Attend building enclosure commissioning meetings. • Provide resolution to items for which the BECxP and Contractor may be in disagreement.
			CM	• Attend building enclosure commissioning meetings.
Construction	Building Enclosure Commissioning Report	Compile a comprehensive commissioning report documenting all building enclosure commissioning activities.	BECxP	• Compile test data, inspection reports, and certificates and include them in the Building Enclosure Commissioning Report. • Provide complete building enclosure commissioning records including all performance test documentation, both in writing and electronic format at the discretion of the Owner.
			CM	• Provide a summary table indexing the building enclosure component requiring maintenance and the frequency for required repair/ replacement as required in the specifications. • Provide maintenance information for each entry containing product data sheets, extended warranty information, sources of materials, and installation and maintenance instructions as required in the specifications. • Provide record drawings, record specifications, and approved product data and shop drawings as required in the specifications.

Building Enclosure Commissioning Schedule

The following is a general outline of the Building Enclosure Commissioning Schedule for the commissioning tasks that will be performed on the project site or at the Commissioning Agent Offices:

Building Enclosure Commissioning Schedule				
Project Phrase	**Task**	**Duration**	**Schedule**	**Predecessors**
Pre-Construction	Submittals and Shop Drawing Review	TBD	Concurrent with A/E review	Receive Submittals and Shop Drawings
Construction	Review Field Checklists	TBD	Scheduled by CM and BECxP	Approval of Product Submittals and Shop Drawings
Construction	Building Enclosure Pre-Construction Commissioning Conference	1 Day	Scheduled by Owner and BECxP	None

Building Enclosure Commissioning Schedule				
Project Phrase	**Task**	**Duration**	**Schedule**	**Predecessors**
Construction	Construction Observation	TBD	Construction observations scheduled concurrent with installation of building enclosure – visits to occur no less bi-weekly. More frequent visits may be scheduled during milestone installations.	Start of site activities and building enclosure components.
Construction	Building Enclosure System and Component Field Testing	TBD	Scheduled by Owner, CM, and BECxP.	Building Enclosure system and component installation commencement.
Construction	Building Enclosure Commissioning Meetings	TBD	Concurrent with building enclosure construction - meetings to be held no less than every two weeks.	Building Enclosure system and component installation commencement.
Post-Construction	Building Enclosure Commissioning Report	TBD	Issued after completion of field testing and construction of the building enclosure.	Building Enclosure system and component construction and field testing.
Post-Occupancy	Post-Occupancy Walk-through	TBD	10 month walk-through to see issues related to air/water leaks and inspect various components of the building enclosure.	Completion of project, field testing and open issues closed at least 10 months prior to this walk-through.

Building Enclosure Performance Testing Activities

The following is a general outline of the Building Enclosure Commissioning Schedule for the Performance Testing activities that will be performed at the construction site. Test requirements listed below apply only as appropriate to the materials, components, and systems specified Section 01 9115 Facility Building Enclosure Commissioning and this BECx Plan.

Performance Testing Activities				
Location / Test Type	**Testing Standard**	**Description**	**Criteria**	**Schedule & Number of Tests**
Air Leakage Testing				
Waterproofing. Performed by waterproofing subcontractor		Sheet Waterproofing	Per manufacturer adhesion test data.	Continuous
Water Leakage Testing				
Hollow metal doors water test for doors, frames and connection to wall assembly	AAMA 501 (water test only, no air pressure)	Water rack or hose on each seam for 5 min.	Intended to evaluate joints, gaskets and sealant details in the closed door position.	For HM Exit Doors: Test one set of double doors and one single door. For each failed test, 1. Identify reason for failure. 2. Repair unit and retest the installation unit until it is completely free of defects. 3. Test two additional of doors

Performance Testing Activities				
Location / Test Type	**Testing Standard**	**Description**	**Criteria**	**Schedule & Number of Tests**
Air and Water Leakage Testing				
Storefront Construction (min chamber size to be determined by A/E) Performed by third party testing agency	AAMA 502	Field Air Leakage Testing and Water Penetration ASTM E783 and ASTM E1105 , procedure "A". Chamber, including adjacent wall substrate, exterior perimeter sealant joint and primary sealant joint	Air Leakage Test <0.06 cfm/ft^2 at 6.24 lbf/ft^2. Minimum water penetration test pressure shall be 8 lbs/ft^2. No water shall penetrate through the perimeter frame or primary sealant joint, be visible on interior surfaces, be visible on the flashing pan, pass beyond the vertical plane at the inner most projection of the curtain wall frame, or be present within the wall cavity.	<u>For Storefront Entry:</u> • One Entry Door Test For each failed test, 1. Identify reason for failure. 2. Repair unit and retest the installation unit until it is completely free of defects. 3. Test Entry door again.
Storefront Construction (min chamber size to be determined by A/E) Performed by third party testing agency	AAMA 503	Field Air Leakage Testing and Water Penetration ASTM E783 and ASTM E1105 , procedure "A". Chamber, including adjacent wall substrate, exterior perimeter sealant joint and primary sealant joint	Air Leakage Test <0.06 cfm/ft^2 at 6.24 lbf/ft^2. Minimum water penetration test pressure shall be 8 lbs/ft^2. No water shall penetrate through the perimeter frame or primary sealant joint, be visible on interior surfaces, be visible on the flashing pan, pass beyond the vertical plane at the inner most projection of the curtain wall frame, or be present within the wall cavity.	<u>For Storefront Window:</u> • One Window Test For each failed test, 1. Identify reason for failure. 2. Repair unit and retest the installation unit until it is completely free of defects. 3. Test Window again. .

Performance Testing Activities				
Location / Test Type	**Testing Standard**	**Description**	**Criteria**	**Schedule & Number of Tests**
Joint Sealants to substrates Performed by sealant manufacturer technical representative or Installer	ASTM C1193 X1-Method A	Sealant Adhesion - Hand Pull Tab	Per manufacturer adhesion test data. Provide locations of test, image of the pulled sealant and pass or fail notation for each location. Sealant to break evenly on each side (snap). Sample width, depth and profile to be reviewed against specifications.	10 locations throughout the construction

SECTION 019115 – FACILITY BUILDING ENCLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

A. This Section includes building enclosure commissioning procedures, including substructure, superstructure, exterior enclosure, and roofing construction that protects climate-controlled interior spaces from unconditioned spaces and the exterior environment, as follows:

1. Below-grade construction including foundations and slab-on-grade that functions as part of the exterior enclosure system but excluding structural systems and components.
2. Superstructure floor and roof construction that functions as part of the exterior enclosure system.
3. Building enclosure construction, above grade, including exterior opaque walls including sheathing, framing, and insulation; windows and doors; and interior finish materials attached to the exterior wall.
4. Roofing, including roofing system, roofing insulation, and skylights, hatches, and other roof openings.

B. The materials, components, systems, and assemblies that comprise the above and below-grade building exterior enclosure will be evaluated and tested as outlined in this Section, as well as in accordance with each of the technical Sections associated with the design and construction of the building exterior enclosure, and the BECx Plan. The purpose of the Building Enclosure Commissioning Program (BECx) will be to provide a process for independent, third-party verification that the installed performance of the building exterior enclosure meets or exceeds the minimum performance requirements set forth by the contract documents for this project.

C. Unless otherwise agreed to in writing between the Owner and Contractor, the BECxP (Building Enclosure Commissioning Provider) will be managed by a registered architect, professional engineer, or other certified commissioning entity (Commissioning Provider) retained by the Owner, and will include, by reference, all requirements set forth by the Architect-of-Record for pre- construction laboratory and field performance testing of the materials, components, systems and assemblies that comprise the building exterior enclosure. In that context, it should be understood by all parties to this project that:

1. Full and complete compliance with the building exterior enclosure performance requirements set forth by the Architect-of-Record in the Basis-of-Design (BOD) for this project will be required to achieve successful “commissioning” of the building exterior enclosure.
2. The requirements of this Section shall in no way relieve the Owner, Contractor, Architect-of-Record and other parties to this project of their respective contractual obligations to the Owner for meeting the specified performance levels in the design and construction of this project.
3. The “commissioning” requirements of the general contractor and sub-contractor or trade

responsible for the final detailing and construction of the building exterior enclosure are included under in Part 1 of each of the technical specification Sections included in this Project Manual as they relate to the design and construction of the building exterior enclosure for this project (Divisions 2 through 9).

D. The Commissioning Provider will provide periodic written summaries (Reports) of the work in progress during the construction of the building exterior enclosure. These reports will include, but may not be limited to, photographs, sketches and diagrams as required illustrating conditions observed in the field, especially deficiencies noted, together with proposed solutions for those conditions where appropriate for further review and acceptance by the Architect-of-Record for the project. Any changes to the contract documents arising out of the Building Exterior Enclosure Commissioning Program must be submitted, reviewed, and accepted in writing, by the Architect-of-Record and Owner and submitted with a series of details/schematics and material specifications to the Contractor for pricing prior to implementation on the project. The Contractor shall be responsible for coordinating and managing the commissioning responsibilities of each of the subcontractors responsible for the building exterior enclosure.

1.2 RELATED SECTIONS:

A. Division 01 Section "General Commissioning Requirements" for general requirements for commissioning including definitions, commissioning team membership, Owner's responsibilities, Contractor's responsibilities, and Commissioning Provider's responsibilities.

B. Division 03 through 14 Sections for facility exterior enclosure commissioning requirements specific to the Work of each Section.

C. Building Enclosure Commissioning Plan is incorporated by appendix with this Section.

1.3 ALLOWANCES

A. Commissioning testing and inspection costs are included in the Commissioning Testing Allowance in Division 01 Section "Allowances" Division 1 Section "Allowances"

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Attend construction-phase coordination meetings.

B. Cooperate with the Commissioning Provider personnel and Building Exterior Enclosure Commissioning consultant, provide access to work, and provide adequate schedule for the work for commissioning tasks.

C. Furnish copies of all shop drawings, manufacturer's literature, installation instructions, maintenance information, schedules, warranties or other information as requested.

D. Provide qualified personnel for assistance to complete the commissioning tests, including seasonal testing and all required air and water leakage testing for elements of the building exterior enclosure.

E. Submit a copy of the General Contractor's project and site-specific Quality Assurance program to be implemented for construction for review by the Architect of Record, the Owner and Owner representatives and the Commissioning Provider, including the building exterior enclosure commissioning subconsultant prior to beginning construction and prior to the kick-off meeting of

the Building Exterior Enclosure Commissioning Process.

F. Participate and ensure all subcontractors utilized for work on this contract participate in meetings prior to beginning construction with the various members of the design and construction teams, including, but not limited to, the Owner, Owner's representatives, Architect of Record, Commissioning Provider including the building exterior enclosure commissioning subconsultant, Mechanical Engineer, suppliers, and manufacturer technical representatives. The subcontractors that must attend this meeting include all subcontractors that will be involved in the construction of the building exterior enclosure, including, but not limited to, the roofing, wall system (including installers for the façade system, including, but not limited to, the masonry, metal panel, siding, and installers for the air barrier system and drainage plane and flashing and water management system), flashing, sealant, fenestration, concrete, steel, HVAC, electrical, interior framing and drywall contractors. This meeting will be to discuss construction sequencing and the coordination of trades and the General Contractor's project and site-specific Quality Assurance program to be implemented that will be completed during construction of the building exterior enclosure.

G. Have a representative present during laboratory structural and air and water leakage performance testing of building exterior enclosure materials or systems, as required in this section, and the BECx Plan

H. Chair monthly or bi-weekly Building Enclosure Quality Assurance Meetings with the appropriate subcontractors in attendance, to review and discuss issues and concerns related to the building exterior enclosure noted by the Architect of Record, the Commissioning Provider, the building exterior enclosure commissioning subconsultant, and the Owner or Owner's representative, during the previous week and what action will be taken to address the noted non-conformances. Maintain a summary of non-conformances and current status.

I. Provide a representative to be present, and have a representative present from each trade and/or subcontractor associated with installing the system during random building exterior enclosure air and water leakage performance testing, as indicated within the individual sections within Divisions 2 through 9, this section and the BECx Plan. Provide a written protocol and a timeline for repair of any deficiencies noted during the performance testing and/or a written report from the third party agency performing the tests indicating what repairs were required. If a systemic problem is identified during testing, please see the following requirement.

J. Provide a repair and remediation protocol for any systemic failures identified by the Commissioning Provider, including a timeline for repair of all affected elements. Repaired elements shall not be covered up without review and documentation by the Commissioning Provider.

K. Provide copies of all test and inspection reports for inclusion in the Systems Manual to be submitted as part of the project closeout documentation.

L. Provide a Systems Manual as part of the project record closeout documentation that includes, but is not limited to, closeout requirements listed in these specifications and more specifically:

1. As-built drawings, including a copy of all details and drawings that were installed as part of any addendums or change order directives. All deviations shall be clearly marked in red pen.
2. Specifications for the project, including all accepted product substitutions and any additional specifications as part of any addendums or change order directives. All accepted product substitutions and all deviations shall be clearly marked in red pen.
3. A copy of all accepted change orders

4. A copy of all final shop drawings for each product requiring shop drawings, with the A/E mark-ups and comments, showing final as-built conditions
5. A copy of all warranties, organized by product, and any and all product manufacturer letters indicating the product as appropriate to use for the application intended on the project as well as any installation guidance
6. A master product list summarizing all products used on the project for construction of the building exterior enclosure, organized by tabs in a binder, including the following information:

    a. Product name
    b. Product manufacturer
    c. Catalog or other applicable number for ordering
    d. Manufacturer's contact information, including the contact information for the technical representatives, including one national contact and one regional technical representative contact
    e. Product color
    f. Supplier contact information
    g. Products installation instructions, including installation instructions supplied with any of the shop drawings that indicated field installed items.
    h. Manufacturer's product maintenance guide.
    i. Manufacturer's checklist for periodic review of the product indicating how often the product should be checked and the process for implementing a repair

M. A Systems Manual is to be developed for each major building exterior enclosure system; including, but not limited to:

1. Roof (penetrations, curbs, etc.)
2. Skylights /Sloped glazing
3. Exterior walls (masonry, precast, metal, insulation, framing, vapor retarder, air barrier, sheathing, etc.)
4. Windows
5. Doors
6. Sealants and expansion joints
7. Control joints
8. Flashings (end dams, drip edges, flexible flashing and metal flashings)
9. Curtain walls or window walls, storefronts
10. Below-grade construction, waterproofing, drainage
11. Floors, slab-on-grade
12. Fire separation/stopping, smoke control and air compartments
13. Other special building exterior enclosure systems, equipment and controls.

N. Participate in maintenance orientation and inspection and in one maintenance and training session with the building operations and maintenance staff and other participants identified by the Owner and Architect-of-Record, with the assistance of the Commissioning Provider.

O. Provide labor and facilities:

1. To provide access to work to be tested
2. For Commissioning Provider's exclusive use, for storage of instruments and drawings, records, and preparation of daily reports

1.5 COMMISSIONING PROVIDER'S RESPONSIBILITIES

A. Cooperate with the Architect and Contractor and provide qualified personnel when scheduled.

B. Promptly notify Architect and Contractor of irregularities or deficiencies in work that are observed during performance of services.

C. Be present to observe all testing of all building exterior enclosure systems as defined in the Contract Documents.

D. Commissioning Provider is not authorized to:

1. Release, revoke, alter or expand requirements of Contract Documents.
2. Approve or accept any portion of the work.
3. Perform any duties of the Contractor.

1.6 COMMISSIONING DOCUMENTATION

A. Provide the following information to Commissioning Provider for inclusion in the Commissioning Plan:

1. Submittals, information for systems manuals, and other required documents and reports.
2. Identification of installed exterior enclosure components, assemblies, systems, and equipment, including design changes that occurred during the construction phase.
3. Certificate of completion, certifying that exterior enclosure assemblies, systems, equipment, and associated controls are complete and ready for testing.
4. Test and inspection reports and certificates.
5. Corrective action documents.

1.7 COMMISSIONING SUBMITTALS

A. Submit commissioning submittals to Commissioning Provider. Submittals requiring Architect's action will be returned to Architect. The Contractor is to provide the following submittals to the Commissioning Provider, including the building exterior enclosure-commissioning subconsultant, in addition to submitting them to the Architect-of-Record. These submittals are in addition to those specified in Division 1 Section 01810 "General Commissioning Requirements."

1. Coordination Drawings: Provide cross references on any and all shop drawings indicating that drawings have been checked and cross-referenced by the Contractor to ensure that adjacent elements (i.e. wall elements and fenestration elements) and the dimensions and construction tolerances indicated will allow all work at interfaces to be constructible
2. Qualifications Data: For fabricators, installers, and testing agencies, submit to the Commissioning Provider for review all qualifications required in Divisions 2 through 9 for review.
3. Preconstruction Test Reports: all preconstruction air and water leakage performance test results, including all failed tests, recording the noted deficiency and the required repair, and provide a copy of all remediation processes and QC/QA processes that will be put in place to address the deficiency on future work product
4. Source Quality Control Reports: retain a copy for field review by the commissioning Provider and include in the closeout submittal a copy of all manufacturer QA/QC reports submitted for products supplied for the project
5. Field Quality Control Reports: provide a copy of the test reports for all field water and air

penetration and other appropriate building exterior enclosure tests completed

6. Special Inspections Reports for all special inspections indicated by the Architect/Engineer-of-Record in the specifications.

1.9 QUALITY ASSURANCE

A. Quality Assurance and Control: Specific commissioning quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Specified commissioning tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

B. Preconstruction Commissioning Conference: Commissioning Provider will schedule a preconstruction commissioning conference before construction of the exterior enclosure starts, at a time convenient to Owner, Contractor, and Architect, but no later than 15 days after execution of the Agreement with the Contractor. Allow for the conference to be held at Project site or another convenient location. The Commissioning Provider will conduct the meeting to review commissioning responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Commissioning Provider, Architect and consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to commissioning.
2. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Commissioning plan
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long-lead items.
    e. Designation of key personnel and their duties.
    f. Procedures for testing and inspecting.
    g. Submittal procedures.
    h. Preparation of Record Documents.
    i. Owner's occupancy requirements.
3. Minutes: Commissioning Provider will record and distribute meeting minutes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 VERIFICATION

A. Certify that building exterior enclosure systems, subsystems, and construction have been completed according to the Contract Documents, including all addenda and change order requirements.

B. Commissioning Provider will witness and document field quality-control tests and inspections.

1. Certify that field quality-control testing of building exterior enclosure has been completed and approved, that discrepancies have been corrected, and corrective work approved. Provide a copy of the list of nonconformances maintained by the General Contractor

indicating all corrections completed.

3.2 DEFERRED TESTING:

1. If tests cannot be completed because of a deficiency outside the scope of the Building Exterior Enclosure, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by Contractor and tests rescheduled.
2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

3.3 TESTING REPORTS:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the building exterior enclosure systems at the time of testing.
2. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated. All repairs are to be documented by the Commissioning Provider.
3. If it is determined that the system is constructed according to the Contract Documents, the Owner will decide whether modifications are required to bring the performance of the system to a level where the failure or deficiency is eliminated and shall be implemented or if the test results will be accepted as submitted. If corrective Work is performed, the Owner will decide if tests shall be repeated and a revised report is to be submitted.

3.4 SYSTEMS TO BE COMMISSIONED

A. Refer to Divisions 2 through 9 of the Specification Sections, this section and the BECx Plan for specific requirements for commissioning each building exterior enclosure element and system. The systems and elements to be commissioned include, but are not limited to:

1. Roofs, including all penetrations, transitions, etc.
2. Skylights and other sloped glazing
3. Exterior walls, including the air barrier system, and water management systems
4. Windows
5. Doors, louvers
6. Sealants and expansion joints
7. Control joints
8. Flashings, including all transitions, end-dams, etc.
9. Curtain walls or window walls, storefront
10. Below-grade construction, including drainage and waterproofing/damp proofing
11. Floors, slab-on-grade
12. Interface conditions between each of the above listed elements
13. Fire separation/stopping, smoke control and air compartments
14. Other special building exterior enclosure systems, equipment and controls.

3.5 FIELD QUALITY CONTROL

A. Waterproofing: Quality Observation Assurance
   1. QOA for waterproofing will include checking for proper surface preparations, ensuring the correct application of waterproofing membranes, inspecting the integrity of seals and joints, and verifying the installation of drainage systems

B. Storefront Testing
   1. The newly installed Storefront Entry shall be field tested by AAMA accredited independent laboratory, in accordance with **AAMA 502 -** uniform pressure, “Voluntary Specification

for Field Testing of Newly Installed Fenestration Products." The area(s) to be tested is (are) as follows:

- Main Entry

2. The newly installed Storefront Window shall be field tested by AAMA accredited independent laboratory, in accordance with **AAMA 503 -** uniform pressure, "Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems." The area(s) to be tested is (are) as follows:
   - Window on West side of CORRIDOR A299G
3. Air Leakage resistant tests shall be conducted at a uniform static test pressure of 6.24 psf. The maximum allowable rate of leakage shall not exceed 0.06 cfm/ft^2
4. Water Penetration test shall be conducted at a static test pressure of 8.0psf for storefronts. For each test that fails, the Architect/Testing Agent will select two additional windows to be tested. All unsuccessful tests, both original and retest as well as additional windows to be tested due to an unsuccessful test will be paid by the Contractor by deduct change order.
5. The window installer is required to carry an allowance to cover attending the testing and for corrective measure is required.
6. Attendance at the window testing is required for the installing Contractor and General Contractor or Construction Manager.
7. Testing Schedule per BECx Plan

C. Hollow Metal Door Testing
   1. The newly installed Hollow Metal doors shall be field testing by AAMA accredited independent laboratory in accordance with **AAMA 501** – Quality Assurance and Diagnostic Water Leakage Field Check. The area(s) to be testes is (are) as follows
      - One double door set
      - One single door
   2. Water Pressure to be 30 – 35 psi at the nozzle inlet. Nozzle to be approx.. 12" away from test area.
   3. The door installer is required to carry an allowance to cover attending the testing and for corrective measure is required.
   4. Attendance at the window testing is required for the installing Contractor and General Contractor or Construction Manager.
   5. Testing Schedule per BECx Plan

D. Sealant pull test at precast panel seams
   1. The newly installed exterior sealant joints of the precast panels shall be tested by sealant manufacturer representative or sub-contractor in accordance with ASTM C1193, X1-Method A.
   2. Sealant installer is required to carry an allowance to cover the repair of the test areas
   3. Construction Manager to have a separate observer or BECxP can observe the tests.
   4. Documentation of the locations and the results to be sent to BECxP, Architect, Owner and Construction Manager.
   5. Testing Schedule per BECx Plan

END OF SECTION 019115

SECTION 02 4100 - DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 7000 - 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.

C. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with requirements in Section 01 7000.

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 permits from authority having jurisdiction.
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 St. Cloud School District 742.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Protect existing structures and other elements to remain in place and not 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.

F. 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.

G. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Comply with requirements of Section 01 7419 - Construction Waste Management and Disposal.
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.

3.02 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and 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 St. Cloud School District 742.

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 St. Cloud School District 742.

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.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
1. Verify 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 areas that remain occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction indicated on drawings .

C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

D. Remove existing work as indicated and required to accomplish new work.
1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
2. Remove items indicated on drawings.

E. Protect existing work to remain.
1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

4. Patch to match new work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove materials not to be reused on site; comply with requirements of Section 01 7419 - 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.

END OF SECTION

SECTION 03 01 30.72 - STRENGTHENING OF CONCRETE WITH FRP (FIBER REINFORCED POLYMER) REINFORCEMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Conditions of the Contract for Construction and the General Requirements of Division 1 of these Specifications apply to the Work in this Section.

1.02 WORK INCLUDED

A. The Work of this Section shall include furnishing all labor, materials, equipment, and supervision to prepare the surface of the structural concrete members and to install the FRP Reinforcement as indicated on the Drawings.

1.03 REFERENCE STANDARDS

A. Comply with the following reference standards, except where more stringent requirements are indicated on the Drawings or specified herein:
   1. American Concrete Institute (ACI)
      a. ACI 440.2R-08, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
      b. ACI 440R-07, Report on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures
      c. ACI 440 R-96, State-of-the-Art Report on Fiber Reinforced Plastic (FRP) Reinforcement for Concrete Structures.
      d. ACI 503 R, Pull-off test to determine FRP adhesion to concrete substrate.
   2. International Concrete Repair Institute (ICRI)
      a. ICRI Guideline No. 03742, Guide for the Selection of Strengthening Systems for Concrete Structures
      b. ICRI Guideline No. 03739, Guide to Using In-Situ Tensile Pull-Off Tests to Evaluate Bond of Concrete Surface Materials
   3. Sika CarboDur Composite Strengthening Systems – Engineering Guidelines for Design and Application.
   4. American Society of Testing and Materials (ASTM) as cited herein.

1.04 QUALITY CONTROL

A. Quality Control procedures performed by the Manufacturer shall include, but not be limited to the following:
   1. Manufacturer shall have a nationally recognized program of contractor training, certification and technical support.
   2. The Manufacturer shall have minimum ten years experience in FRP Reinforcement confirmed by actual field tests of minimum 100 successful installations.
   3. The Manufacturer shall be able to supply testing data to demonstrate system properties and durability of the actual FRP Reinforcement to be used.

B. Quality Control procedures performed by the Contractor shall include, but not be limited to the following:
    1. The Contractor shall be trained by the Manufacturer and shall have completed a program of instruction in the use of FRP Reinforcement.
    2. The Contractor shall have a minimum of two years experience in FRP Reinforcement confirmed by actual field tests of at least 5 successful installations.
    3. The Contractor shall inspect all materials prior to application to assure that they meet specifications and have arrived to the job-site undamaged.
    4. The FRP Reinforcement shall be completely inspected by the contractor during and immediately following application of the composite materials. Conformance with the design drawings, proper alignment of fibers and quality workmanship shall be assured. Entrapped air shall be released or rolled out before the epoxy sets. Defects shall be noted in the Daily Construction Log.
    5. After FRP Reinforcement has cured, the contractor shall inspect the all work to check for voids and or debonding. Repairs shall be made as per Par. 3.7 Repair of Defects, and noted in the Daily Construction Log.

1.05 SUBMITTALS

A. Submit for record Material Safety Data Sheets (MSDS) of each product, used on site.
B. Submit product data indicating product standards, physical and chemical characteristics, environmental durability, technical specifications, limitations, installation instructions, and general recommendations regarding each material.
C. Submit for record, a qualification statement by the Contractor listing their completed FRP Reinforcement projects, including size, location, owner, engineer/architect and contact numbers.
D. Submit for record a complete description of the FRP Reinforcing system materials, surface preparation, application procedures, application rates, and cure times.
E. Submit for record copies of purchase order and packaging slips showing quantities and dates of primer and resin purchased.
F. Submit for review and approval shop drawings including, the following:
    1. Limits of FRP Reinforcing.
    2. Details of epoxy injection crack repair and epoxy resin patching.
    3. Complete system details including, but not limited to, FRP Reinforcement, primer, resin, and protective coating.
G. Submit for record test results of the Pull-off test to determine FRP adhesion to concrete substrate.
H. Submit for record Daily Construction Logs kept by the Contractor. These logs shall include the following information: Weather and temperature at application times; Amount of product used and square footage/linear footage of substrate covered; Batch numbers of all products used; Names of all crew members; Any bond-strength tests, noting location, quantity and who performed these tests.

I. Submit an approved ICC Evaluation Report in the name of the proposed FRP system to be used on this project.

J. Submit independent test report verifying the environmental durability of the proposed system to be used on this project. Such reports shall include as a minimum:

1. 10,000 hr. resistance to salt water
2. 10,000 hr. resistance to high temperature (38C) and high humidity (100%)
3. 10,000 hr. resistance to alkali solution (pH 9.5)
4. 3,000 hr. resistance to dry heat (60C)
5. resistance to 20 freeze/thaw cycles
6. resistance to UV/condensation @ 100 cycles
7. resistance to diesel fuel (4 hr. exposure)

1.06 JOB-SITE CONDITIONS

A. Do not apply FRP Reinforcement materials if raining, snowing, or dew condensation is expected or existing concrete surface is wet or if the ambient or surface temperature are below 40° F (4°C).

B. The ambient temperature and temperature of the epoxy components shall be between 50° F (10°C) and 80° F (27°C) at the time of mixing. See appropriate technical data sheets for more specific instructions.

C. Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.

D. The Contractor is solely responsible for fume control and shall take necessary precautions against injury to Installer personnel or adjacent building occupants during application of primer and resin, etc. Contractor personnel shall use protective equipment and area shall be well vented to the outside. As a minimum, Installer must take the following precautions:

1. Contractor to locate and protect building air intake during application.
2. Contractor to follow all state, federal, and local safety regulations.
3. Contractor to follow all Manufacturers' safety requirements as indicated on appropriate MSDS sheets.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver primer, saturant and protective coating in original, unopened containers with the Manufacturer's name, labels, product identification, and batch numbers.

B. FRP Reinforcement shall be stored in a cool dry area away from direct sunlight, flame, moisture, or other hazards.

C. Store primer, saturant and protective coating under conditions as recommended by the Manufacturer in a cool dry place out of direct sunlight. Products that have exceeded their shelf life shall not be used.

D. Contractor is required to confirm that all materials used in accordance with this Section conform to local, state, and federal environmental and worker's safety laws and regulations.

E. During operations Contractor shall maintain barricades.

F. The Contractor shall properly dispose of empty containers in accordance with local regulations.

PART 2 - PRODUCTS

2.01 FRP REINFORCEMENT FABRIC AND/OR LAMINATE

A. FRP Reinforcement fabric shall be high strength, high modulus, fiber fabric that may be unidirectional or woven (in various fiber architectures) to suit specific repair needs.

1. FRP Reinforcement fabric shall be of the type, size, layer and location as indicated on the Drawings.
2. FRP Reinforcement fabric shall meet the following minimum requirements:

	SikaWrap Hex 100G	SikaWrap Hex 103C	
Property* Prior to testing, laminate samples shall be cured at least 7 days at 70°F then post-cured at 140°F for 48 hours	**Requirement**	**Requirement**	**ASTM Test Method**
Laminate Tensile Strength, In primary fiber direction – 1 layer, per inch width	3,000 lbs./layer (13.3 kN/layer)	3,775 lbs./layer (16.8 kN/layer)	D3039
Laminate Tensile Modulus, In primary fiber direction	3.4×10^6 psi (23,400 MPa)	9.0×10^6 psi (62,000 MPa)	D3039
Laminate Elongation at break	2.00%	0.91%	D3039
Dry Fabric Weight, Minimum, per square yard	27 oz./yd^2 (913 g/m^2)	18 oz./yd^2 (618 g/m^2)	
Percent Laminate Tensile Strength Retained after:			
7 days, 100% humidity,100°F (38°C) 3,000 hrs	90%	90%	
exposure to alkali	90%	90%	
3,000 hrs exposure to salt water	90%	90%	
3,000 hrs exposure at 140°F (60°C)	90%	90%	
Visual Defects			D2563

3. Approved products are:
    a. SikaWrap Hex Fabrics (100G, 106G, 107G, 320G, 430G, 103C, 113C, 117C, 230C), Sika Corp, Lyndhurst, NJ.
    b. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

B. FRP Precured Strip shall be high strength, high modulus, unidirectional carbon fiber reinforced polymer (CFRP).

1. FRP Precured Strip shall be of the type, size, layer and location as indicated on the Drawings.
2. FRP Precured Strip, shall meet the following minimum requirements:

	Sika CarboDur Strip	
Property	**Requirement**	**ASTM Test Method**
Laminate Tensile Strength, In primary fiber direction	406,000 psi (2,800 MPa)	D3039

Laminate Tensile Modulus, In primary fiber direction	$23.2x10^6$ psi (160,000 MPa)	D3039
Laminate Elongation at break	1.69 %	D3039
Laminate Thickness	0.047 in. (1.2mm)	
Fiber Volume, minimum	68%	D2563

3. Approved products are:
    a. Sika CarboDur, Sika Corp., Lyndhurst, NJ.
    b. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

2.02 CONCRETE SURFACE PRIMER

A. Surface Primer shall be a two component, 100% solids, moisture/tolerant, high modulus, high strength epoxy.

B. Surface Primer shall meet the following minimum requirements:

	Sikadur 300	Sikadur 330	
Property	**Requirement**	**Requirement**	**ASTM Test Method**
Tensile Strength	8,000 psi	4,900 psi	D638
Tensile Modulus	250,000 psi	---	D638
Elongation at Break	3.0%	1.2%	D638
Flexural Strength	11,500 psi	---	D790
Flexural Modulus	500,000 psi	506,000 psi	D790
Heat Deflection Temp. (HDT)	117F (47C)	120F (48C)	D648

C. Approved products are:
    1. Sikadur 300, Sika Corp., Lyndhurst, NJ.
    2. Sikadur 330, Sika Corp., Lyndhurst, NJ.
    3. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

2.03 FABRIC SATURANT

A. Saturant resin shall be two component, 100% solids, moisture tolerant, high strength, high modulus epoxy.

B. Saturants shall meet the following minimum requirements:

	Sikadur 300	Sikadur 330 (Dry Lay-up)	
Property	**Requirement**	**Requirement**	**ASTM Test Method**
Tensile Strength	8,000 psi	4,900 psi	D638
Tensile Modulus	250,000 psi	---	D638
Elongation at Break	3.0%	1.2%	D638
Flexural Strength	11,500 psi	---	D790
Flexural Modulus	500,000 psi	506,000 psi	D790
Heat Deflection Temp. (HDT)	120 F	120F (48C)	D648

C. Approved products are:

1. Sikadur 300, Sika Corp, Lyndhurst, NJ.
2. Sikadur 330 (Dry Lay-up), Sika Corp, Lyndhurst, NJ.
3. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

2.04 EPOXY REPAIR MORTAR

A. Repair mortar shall be 100% solids, non-sag paste epoxy.

B. Approved products are:

1. Sikadur 30, Sika Corp., Lyndhurst, NJ.
2. Sikadur 31, Sika Corp., Lyndhurst, NJ
3. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

2.05 PROTECTIVE COATING

A. Protective coating shall be polymer or acrylic based and shall be UV resistant.

B. Approved products are:

1. Sikagard 550W, Sika Corp., Lyndhurst, NJ.
2. Sikagard 670W, Sika Corp., Lyndhurst, NJ.
3. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

PART 3 - EXECUTION

3.01 GENERAL

A. Inspect surfaces to receive the work and report immediately in writing to the Engineer as required in the General Conditions and deficiencies in the surface that render if unsuitable for proper execution of this work.

B. Protect vehicles, concrete, and other items surrounding work area from dust or damage due to Work of this Section.

3.02 SURFACE PREPARATION

A. All concrete surfaces shall be dry and free of surface moisture and frost, and tested by the Contractor to evaluate moisture transmission in accordance with ASTM D4263 “Indicating Moisture in Concrete by the Plastic Sheet Method.“

B. All concrete surfaces shall be sound. Remove deteriorated concrete, dust, laitance, grease, paint, curing compounds, waxes, impregnations, foreign particles, and other bond inhibiting materials from the surface by blast cleaning or equivalent mechanical means.

C. All concrete surfaces shall be air blasted and vacuumed clean to a dust free condition.

D. Concrete surface irregularities less than one inch shall be ground and smoothed and/or filled with an approved repair mortar (e.g., Sikadur 30) with the addition of 1 part oven dried sand to make an epoxy mortar. Surface irregularities shall be limited to less than 0.04 inches (1 mm). Surface irregularities greater than one inch shall be repaired using an approved cementitious repair mortar (e.g. SikaTop 123).

E. External concrete corners shall be rounded to at least a 1/2" radius when perpendicular to fiber orientation and internal corners shall be smoothed by trowelling epoxy mortar into the corners.

F. The adhesive strength of the concrete shall be verified after preparation by random pull-off testing (ACI 503R) at the direction of the Engineer. Minimum tensile strength is 200 psi with concrete substrate failure, or as approved by the Engineer.

3.03 MIXING PRIMER AND SATURANT

A. Mix components in accordance with Manufacturer's recommendations.

B. Diluting is not permitted. Pre-condition materials as indicated on technical data sheet.

C. Mix only that quantity which can be used within its pot life.

D. Do not batch delivered units into smaller quantities. Mix only full units.

3.04 PRIMER APPLICATION

A. Apply primer in accordance with Manufacturer's recommendations.

B. Primer may be applied with a brush or roller. Apply second coat as necessary after first coat has penetrated into concrete.

C. Surface depressions shall be filled with epoxy filler per manufacturers' instructions.

D. Primer must be covered with fiber within 24 hours of application, depending on temperature conditions. If 24-hour window is exceeded, the primed surfaces must be solvent wiped with a fast flashing solvent (e.g. MEK) or roughened with sandpaper to break the amine blush.

3.05 FRP REINFORCEMENT APPLICATION

A. Method 1: Wet Lay-Up

1. Apply FRP Reinforcement in accordance with Manufacturer's recommendations.
2. When using saturator equipment, follow Manufacturer's procedures for proper machine set-up and calibration. Rollers shall be calibrated to saturate the fabric with the proper resin-to-fabric ratio. The roller gap shall be checked daily by a qualified technician for accuracy. The resin-to-fabric ratio shall also be verified by resin usage and documented on the daily project logs.
3. Once the fabric is saturated, it may then either be spooled for easy handling, or cut to specified lengths and booked for handling. Care must be taken not to damage the fibers.
4. The fabric may then be applied to the surface with no delay. Work from one end to the other, taking care to orient the fibers as specified. Remove any air entrapped in the fabric with a ribbed roller or squeegee.
5. Sheets shall be lapped in the longitudinal direction 6 inches minimum or as indicated on the Drawings. Note: no lapping is required of the sheets parallel to the direction of fiber orientation.

B. Method 2: Dry Lay-Up

1. Apply FRP Reinforcement in accordance with Manufacturer's recommendations.
2. FRP Reinforcement sheets shall be cut beforehand into prescribed lengths. Sheets shall be lapped in the longitudinal direction 6 inches minimum or as indicated on the Drawings. Note: no lapping is required of the sheets parallel to the direction of fiber orientation.

3. Follow Manufacturer's recommendations regarding primer open times.
4. Apply a primary saturant coat uniformly by roller brush.
5. Apply FRP Reinforcement sheets fiber side down to the concrete over the fresh saturant using a ribbed roller to remove any air bubbles.
6. FRP Reinforcement sheets shall be left alone for about 30 minutes allowing for the primary saturant to soak through the fabric. Correct any dislocation on lifting.
7. Apply secondary saturant coat with roller over installed sheets in order to impregnate and replenish primary saturant.
8. If succeeding FRP Reinforcement sheets are specified on the Drawings repeat application procedures.

C. Method 3: Precured Strip Application
1. Apply FRP Precured Strip in accordance with Manufacturer's recommendations.
2. Care shall be taken not to damage the fibers in handling and unpacking the Strips.
3. Strips may be either delivered to project site in factory pre-cut lengths, or cut on site. Care must be taken not to fray or otherwise damage the fibers when field cutting. Follow Manufacturer's recommendations for field cutting of strips.
4. Strips shall be cleaned with a fast flashing solvent (e.g. MEK) to remove any bond inhibiting materials. A clean white cotton rag shall be used for this purpose. Continue cleaning the Strip in this manner until no black residue shows on the rag. Cleaning shall be performed the same day the strips are to be used.

3.06 CURING

A. Protect finished installation of FRP Reinforcement from rain, sand, dust, etc. using protective sheeting or other barriers. Do not allow protective sheeting to come in contact with finished application.

B. Curing of finished application shall be a minimum of 24 hours and in order to achieve full strength curing shall be extended for a period of two weeks at an average ambient temperature of 68°F.

3.07 REPAIR OF DEFECTS

A. Upon completion of the curing process, the installed system shall be checked for areas where saturant has not penetrated or where saturant has not completely cured. Such areas shall be epoxy injected to re-establish bond subject to the approval of the Project Engineer.

B. Repair procedures shall be performed in accordance with guidelines established by ACI 440.2R-08 (paragraph 7.2.3) and approved by the Project Engineer. All repairs shall be subject to the same application, curing and quality control specifications as the original work.
1. Small delaminations and voids less than 2 in^2 each are permissible as long as the delaminated area is less than 5% of the total laminate area and there are no more than 10 such delaminations per 10 ft^2.
2. Medium sized delaminations and voids greater than 2 in^2 but less than 25 in^2 may be repaired by epoxy resin injection or ply replacement, depending on the size and number of delaminations and their location. The repair procedure should be determined by the Project Engineer.

3. Larger size delaminations and voids greater than 25 in^2 should be repaired by selectively cutting away the affected sheet and applying an overlapping sheet patch of equivalent plies. The overlap should extend a minimum of 6 in. in all directions.

3.08 PROTECTIVE COATING

A. Apply protective coating in accordance with Manufacturer's recommendations.

3.09 CLEANING

A. Uncured saturants may be cleaned from tools with an approved solvent and properly disposed.

B. Cured saturants shall be removed by mechanical means and properly disposed.

END OF SECTION

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Form-facing material for cast-in-place concrete.
   2. Shoring, bracing, and anchoring.

B. Related Requirements:
   1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.

1.03 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.04 ACTION SUBMITTALS

A. Product Data: For each of the following:
   1. Exposed surface form-facing material.
   2. Pan-type forms.
   3. Form ties.
   4. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
   1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
   2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
      a. Location of construction joints is subject to approval of the Architect.
   3. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.
   4. Indicate layout of insulating concrete forms, dimensions, course heights, form types, and details.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
   1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
   2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.02 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:
   1. Provide continuous, true, and smooth concrete surfaces.
   2. Furnish in largest practicable sizes to minimize number of joints.
   3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
      a. Plywood, metal, or other approved panel materials.

2.03 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
   2. Form release agent for form liners shall be acceptable to form liner manufacturer.

F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

PART 3 - EXECUTION

3.01 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes .

C. Limit concrete surface irregularities as follows:
   1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
   2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
   3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.
   1. Minimize joints.
   2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
   1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
   2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
    1. Provide and secure units to support screed strips
    2. Use strike-off templates or compacting-type screeds.
H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
    1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
    2. Locate temporary openings in forms at inconspicuous locations.
I. Chamfer exterior corners and edges of permanently exposed concrete.
J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
    1. Determine sizes and locations from trades providing such items.
    2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
L. Construction and Movement Joints:
    1. Construct joints true to line with faces perpendicular to surface plane of concrete.
    2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
    3. Place joints perpendicular to main reinforcement.
    4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
        a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
    5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
    6. Space vertical joints in walls as indicated on Drawings .
        a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
    1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
    2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
    1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediately prior to concrete placement.

3.03 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work.
   1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
   2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
   1. Align and secure joints to avoid offsets.
   2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

D. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

END OF SECTION

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    a. For concrete surfaces exposed to view, where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
   a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
   2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
   3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .
   1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Concrete Subcontractor.
   2. Review the following:
      a. Special inspection and testing and inspecting agency procedures for field quality control.
      b. Construction joints, control joints, isolation joints, and joint-filler strips.
      c. Semirigid joint fillers.
      d. Vapor-retarder installation.
      e. Anchor rod and anchorage device installation tolerances.
      f. Cold and hot weather concreting procedures.
      g. Concrete finishes and finishing.
      h. Curing procedures.
      i. Forms and form-removal limitations.
      j. Shoring and reshoring procedures.
      k. Methods for achieving specified floor and slab flatness and levelness.
      l. Floor and slab flatness and levelness measurements.
      m. Concrete repair procedures.
      n. Concrete protection.
      o. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
      p. Protection of field cured field test cylinders.

1.04 ACTION SUBMITTALS

A. Product Data: For each of the following.
   1. Portland cement.
   2. Fly ash.
   3. Slag cement.
   4. Blended hydraulic cement.
   5. Silica fume.
   6. Performance-based hydraulic cement
   7. Aggregates.
   8. Admixtures:
      a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
   9. Vapor retarders.
   10. Curing materials.
   11. Joint fillers.

1.05 DESIGN MIXTURES: FOR EACH CONCRETE MIXTURE, INCLUDE THE FOLLOWING:

A. Mixture identification.
B. Minimum 28-day compressive strength.
C. Durability exposure class.
D. Maximum w/cm.
E. Calculated equilibrium unit weight, for lightweight concrete.
F. Slump limit.
G. Air content.
H. Nominal maximum aggregate size.
I. Steel-fiber reinforcement content.
J. Synthetic micro-fiber content.
K. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
L. Intended placement method.
M. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.06 SHOP DRAWINGS:

A. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

1.07 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Curing compounds.
   4. Bonding agents.
   5. Adhesives.
   6. Vapor retarders.

7. Semirigid joint filler.
8. Joint-filler strips.

B. Field quality-control reports.

1.08 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.010 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.02 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II , .
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.03 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A ; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.04 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.05 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
   1. Color:
      a. Ambient Temperature Below 50 deg F: Black.
      b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
      c. Ambient Temperature Above 85 deg F: White.

D. Water: Potable or complying with ASTM C1602/C1602M.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B , certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating , certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.06 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber .

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.07 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for parking structure slabs, and concrete with a w/cm below 0.50.

2.08 CONCRETE MIXTURES

A. Class A : Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: ACI 318 F1 S0 W1 C1 .
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50 .
4. Slump Limit: 4 inches , plus or minus 1 inch 8 inches , plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site .
5. Air Content:
   a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size .
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

B. Class B : Normal-weight concrete used for foundation walls.

1. Exposure Class: ACI 318 F2 S0 W1 C1 .
2. Minimum Compressive Strength: 4500 psi at 28 days.
3. Maximum w/cm: 0.45 .
4. Slump Limit: 5 inches , plus or minus 1 inch 8 inches , plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site .

5. Air Content:
    a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

C. Class C : Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: ACI 318 F0 S0 W0 C0 .
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50 .
4. Minimum Cementitious Materials Content: 540 lb/cu. yd. .
5. Slump Limit: 5 inches , plus or minus 1 inch .
6. Air Content:
    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

D. Class D : Normal-weight concrete used for interior suspended slabs including tunnel slabs.
1. Exposure Class: ACI 318 F0 S0 W0 C0 .
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50 .
4. Minimum Cementitious Materials Content: 540 lb/cu. yd. .
5. Slump Limit: 5 inches , plus or minus 1 inch 8 inches , plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site .
6. Air Content:
    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

E. Class G : Normal-weight concrete used for building frame members (columns and beams).
1. Exposure Class: ACI 318 F2 S0 W1 C1.
2. Minimum Compressive Strength: 5000 psi at 28 days.
3. Maximum w/cm: 0.40 .
4. Slump Limit: 5 inches , plus or minus 1 inch 8 inches , plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site .
5. Air Content:
    a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size .
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

2.09 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

B. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.03 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.04 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.
    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.05 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.
    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.
3. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated on Drawings . Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
   1. If a section cannot be placed continuously, provide construction joints as indicated.
   2. Deposit concrete to avoid segregation.

F. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

G. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
   a. Do not use vibrators to transport concrete inside forms.
   b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
   c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
   d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

H. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Do not place concrete floors and slabs in a checkerboard sequence.
   2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Maintain reinforcement in position on chairs during concrete placement.
   4. Screed slab surfaces with a straightedge and strike off to correct elevations.
   5. Level concrete, cut high areas, and fill low areas.
   6. Slope surfaces uniformly to drains where required.
   7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
   8. Do not further disturb slab surfaces before starting finishing operations.

3.07 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:
   1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
      a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
      b. Remove projections larger than 1 inch.
      c. Tie holes do not require patching.
      d. Surface Tolerance: ACI 117 Class D.
      e. Apply to concrete surfaces not exposed to public view .
   2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
      a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
      b. Remove projections larger than 1/4 inch.
      c. Patch tie holes.
      d. Surface Tolerance: ACI 117 Class B.
      e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete .

B. Related Unformed Surfaces:
   1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.

2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:
   1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
   2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
   3. Apply float finish to surfaces to receive trowel finish .

C. Trowel Finish:
   1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
   2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
   3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   4. Do not add water to concrete surface.
   5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
   6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system .
   7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
      a. Slabs on Ground:
         1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings . While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
   1. Coordinate required final finish with Architect before application.
   2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
   2. Coordinate required final finish with Architect before application.

3.09 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
   1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.

2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
   a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Cast anchor-bolt insert into bases.
   c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.010 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

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

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:
    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.
        3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
            a) Water.
            b) Continuous water-fog spray.
    b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.
        3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
            a) Water.
            b) Continuous water-fog spray.
    c. Floors to Receive Polished Finish: Contractor has option of the following:
        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
        2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
            a) Water.
            b) Continuous water-fog spray.
    d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:
1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing and Sealing Compound:
1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.011 TOLERANCES

A. Conform to ACI 117.

3.012 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s).
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.013 CONCRETE SURFACE REPAIRS

A. Defective Concrete:
1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
a. Limit cut depth to 3/4 inch.
b. Make edges of cuts perpendicular to concrete surface.
c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Fill and compact with patching mortar before bonding agent has dried.

e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
   a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
   b. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:
1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
   a. Correct low and high areas.
   b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
   a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
   a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
   a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
   b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
   c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
   d. Place, compact, and finish to blend with adjacent finished concrete.
   e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.
   c. Place patching mortar before bonding agent has dried.
   d. Compact patching mortar and finish to match adjacent concrete.
   e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.014 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Slump: ASTM C143/C143M:
    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M:
    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .
    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:
    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C31/C31M:
    a. Cast and laboratory cure two sets of two 4-inch by 8-inch cylinder specimens for each composite sample.
    b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C39/C39M.
    a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
    c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:
    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
        1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.015 PROTECTION

A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION

SECTION 03 3511 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments.

B. Polished concrete.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

B. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 3000 - 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-UPS

A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.07 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 50 degrees F (10 degrees C) minimum.

PART 2 PRODUCTS

2.01 CURING MATERIALS

A. Curing and Sealing Compound, Low Gloss (CSLR-1): Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.

1. Apply in accordance with manufacturer's instructions during concrete curing.
2. Near Substantial Completion, apply a final coat(s) to produce a consistent, uniform low gloss finish to floor areas indicated to receive (CSLR-1).
3. Solids by Mass: 25 percent, minimum.
4. Products:

a. Dayton Superior Corporation; Cure & Seal 1315 J22WB: www.daytonsuperior.com.
b. TCC Materials; Tenon Cure & Seal WB 1315: www.tccmaterials.com.
c. W. R. Meadows, Inc; VOCOMP-25: www.wrmeadows.com.
d. BASF; Kure 1315: www.buildingsystems.basf.com].
e. Scofield; Cureseal-W: www.scofield.com.
f. Substitutions: See Section 01 6000-Product Requirements.

2.02 POLISHED CONCRETE SYSTEM

A. Polished Concrete System (PCONC-1): Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen; including edge conditions:
   1. Level of Cut:
      a. Mechanical grind off existing glue:
         1) Class B – Fine Aggregate (Salt/Pepper) Finish - Expose the fine aggregate such as sand and small aggregate with the concrete. The depth of grind will depend greatly on the placement and finishing procedures. Generally, this level of cut can be achieved within 1/16” of the surface.
   2. Level of Sheen:
      a. Level 1 Sheen, Flat Appearance as determined by a gloss reading of 0 – 10. (100 grit); honed 200 grit finish.
   3. Edge Conditions: Polished along with main body.
   4. Products:
      a. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; FGS Permashine Concrete Polishing System: www.lmcc.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

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 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.
B. Remove surface contamination

3.04 CONCRETE POLISHING

A. Provide consistent finish in all contiguous areas.
B. Apply floor finish prior to installation of fixtures and accessories.
C. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit. Installer to determine the optimum starting grit in order to achieve the specified aggregate exposure.

1. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Following the initial passes of metal bond diamonds, the installer shall drop back a minimum of one grit level when transitioning to resin bond diamonds. The separation in grit designation shall be a minimum of 50 for the transitioning step. The installer shall refine each abrasive grit to its fullest potential before moving on to the next level. FLoor shall be thoroughly scrubbed between each grit pass to remove all loose material. Level of sheen shall match that of mock-up.
2. Expose aggregate in concrete surface only as determined by approved mock-up.
3. All concrete surfaces shall be as uniform in appearance as possible.

D. Apply manufacturer's recommended densifier, hardener as recommended for polishing system.
1. Basis of Design: FGS Hardener Plus; two coats.
a. First Coat: Install at 250 sf/gal, following 400 grit level.
b. Second Coat: Install at 350 sf/gal, prior to the final polishing pass.
c. Follow manufacturer's recommendations for drying time between successive coats.

E. Remove defects and re-polish defective areas.

F. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

G. Apply EP80 joint filler at polished concrete by Metzer/McGuire: www.metzgermcquire.com.

3.05 ADJUSTMENTS

A. Re-polish those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface prior to the start of polishing operations.

3.06 PROTECTION

A. Protect installed product from damage during construction.

END OF SECTION

SECTION 03 4100 - PRECAST STRUCTURAL CONCRETE - FOR REFERENCE ONLY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Columns and bearing saddles.
B. Beams, spandrels, girders, purlins.
C. Grout packing.

1.02 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.
D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
E. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
G. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products; 2021.
H. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.
I. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.
C. Shop Drawings: Indicate layout, unit locations, fabrication details, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials. Indicate design loads, deflections, cambers, bearing requirements, and special conditions.
D. Design Data: Submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State in which the Project is located.
B. Fabricator Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
C. Erector Qualifications: Company specializing in erecting products of this section with not less than three years experience.
D. 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.

1.05 MOCK-UP

A. Stadia Mock-Up: Provide a mock-up of a stadia section indicating finish, chamfers, and smoothness. Mock-up shall be available for view at the precast plant.
   1. Mock-up shall be approved by Architect prior to manufacturing remaining stadia sections. The mockup shall represent the finish standard for the remaining sections.
   2. Mock-up may be used in construction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle precast members in position consistent with their shape and design. Lift and support only from support points.
B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.
C. Protect members to prevent staining, chipping, or spalling of concrete.
D. Mark each member with date of production and final position in structure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Precast Concrete:
   1. Gage Brothers Concrete Products, Inc: gagebrothers.com.
   2. Wells Concrete Products: www.wellsconcrete.com.
   3. Molin Concrete Products: www.molin.com.
   4. Taracon Precast: www.taraconprecast.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRECAST UNITS

A. Precast Structural Concrete Units: Comply with PCI MNL-116, PCI MNL-120, PCI MNL-123, PCI MNL-135, ACI CODE-318, and applicable codes.
   1. Design components to withstand dead loads and design loads in the configuration indicated on the drawings.
   2. Calculate structural properties of framing members in accordance with ACI CODE-318.
   3. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with strength requirements.
   4. Design members exposed to the weather to provide for movement of components without damage, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal or cyclic day/night temperature ranges.
   5. Design system to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

2.03 MATERIALS

A. Cement: White Portland type, complying with ASTM C150/C150M, Type I.
B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator as appropriate to design requirements and PCI MNL-116.

2.04 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
   1. Plain billet-steel bars.
   2. Unfinished.

B. Steel Welded Wire Reinforcement: ASTM A1064/A1064M plain type or deformed type; in flat sheets; unfinished.

2.05 FABRICATION

A. Comply with fabrication procedures specified in PCI MNL-116.

B. Maintain plant records and quality control program during production of precast members. Make records available upon request.

C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on shop drawings.

D. Provide required openings with a dimension larger than 10 inches (250 mm) and embed accessories provided under other sections of the specifications, at indicated locations.

2.06 FABRICATION TOLERANCES

A. Comply with fabrication tolerances specified in PCI MNL-135, except as specifically amended below.

1. Variation From Nominal Dimension: Plus or minus 1/2 inch (12.5 mm).
2. Variation From Intended Camber: Plus or minus 1/4 in per 10 ft (6 mm per 3 m), plus or minus 5/8 inch (15 mm) maximum.
3. Variation from End Squareness: Plus or minus 1/8 inch/12 in (3 mm/300 mm), maximum 3/8 in (9 mm).
4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch (3 mm).
5. Sweep: Plus or minus 1/4 inch (6 mm).

2.07 FINISHES

A. Ensure exposed-to-view finish surfaces of precast concrete members are uniform in color and appearance.

B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

C. Architectural Finish: Surface holes or bubbles over 1/4 inch (6 mm) filled with matching cementitious paste, fins or protrusions removed and surface ground smooth.

2.08 ACCESSORIES

A. Connecting and Supporting Devices; Anchors and Inserts: Plates, angles, items cast into concrete, items connected to steel framing members, and inserts complying with PCI MNL-123 and as follows:

1. Material: Carbon steel complying with ASTM A36/A36M.
2. Finish: Prime painted, except where device surfaces will be in contact with concrete or will require field welding.

B. Grout: Non-shrink, non-metallic, minimum yield strength of 10,000 psi (69 MPa) at 28 days.

C. Bearing Pads: High density plastic, Vulcanized elastomeric compound molded to size, Neoprene (Chloroprene), or Tetrafluoroethylene(TFE); Shore A Durometer as recommended by manufacturer; 1/8 inch (3 mm) thick, smooth both sides.

D. Bolts, Nuts and Washers: High strength steel type recommended for structural steel joints.

E. Prime Paint: Zinc rich alkyd type.

2.09 SOURCE QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Provide mix design for concrete.

B. Test samples in accordance with applicable ASTM standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and field measurements are as indicated on shop drawings.

3.02 PREPARATION

A. Prepare support equipment for the erection procedure, temporary bracing, and induced loads during erection.

3.03 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
B. Align and maintain uniform horizontal and vertical joints, as erection progresses.
C. Maintain temporary bracing in place until final support is provided. Protect members from staining.
D. Provide temporary lateral support to prevent bowing, twisting, or warping of members.
E. Adjust differential camber between precast members to tolerance before final attachment.
F. Install bearing pads.
G. Level differential elevation of adjoining horizontal members with grout to maximum slope of 1:12.
H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers.
I. Grout underside of column bearing plates.
J. Secure units in place. Perform welding in accordance with AWS D1.1/D1.1M.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances.
B. Conform to PCI MNL-135 for erection tolerances.
C. When members cannot be adjusted to comply with design or tolerance criteria, cease work and advise Architect. Execute modifications as directed.

3.05 PROTECTION

A. Protect members from damage caused by field welding or erection operations.
B. Provide non-combustible shields during welding operations.

3.06 CLEANING

A. Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION

SECTION 03 4500 - PRECAST ARCHITECTURAL CONCRETE - FOR REFERENCE ONLY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete wall panels.
B. Supports, anchors, and attachments.
C. Grouting under panels.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing perimeter and intermediate joints.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
H. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
I. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.
J. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).
L. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
M. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2023.
N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
O. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2013.
P. PCI MNL-120 - PCI Design Handbook; 2025.
Q. PCI MNL-122 - Architectural Precast Concrete; 2007.
R. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.
S. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Provide erection drawings.
   1. Include details of mix designs.
   2. Include structural design calculations.

D. Fabricator's Qualification Statement: Provide documentation showing precast concrete fabricator is accredited under IAS AC157.

E. Delegated-Design Submittal: For architectural precast concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, licensed in the state of Minnesota, responsible for their preparation.
   1. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

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 the State in which the Project is located.

B. Fabricator Qualifications:
   1. Firm having at least 2 years of 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 AA.

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. Gage Brothers Concrete Products, Inc: gagebrothers.com.
   2. Molin Concrete Products: www.molin.com.
   3. Taracon Precast: www.taraconprecast.com.
   4. Wells Concrete Products: www.wellsconcrete.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design architectural precast concrete units.

B. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated. Structure to comply with ICC 500-14 Storm Shelter requirements as indicated on the structural drawings.

C. Structural Performance: Architectural precast concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.

D. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the design loads indicated within limits and under conditions indicated:

1. Design architectural precast concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain architectural precast concrete deflections within limits of ACI 318.
    a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F.

2.03 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI CODE-318.

1. Concrete Face Mix: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 5 to 7 percent; comply with ACI SPEC-301.
2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
3. Calculate structural properties of units in accordance with ACI CODE-318.
4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.
6. Control joints in individual panels are NOT acceptable.

B. Insulated Wall Panel (PC PNL-1): Precast concrete wall panel with foam insulation sandwiched by interior and exterior concrete. See drawings for thicknesses.

C. Wall Panel without Insulation (PC PNL-2): Precast concrete wall panel without insulation. See drawings for thicknesses.

D. No Integral Color:

1. (PCFIN-20): Finish: None.
2. (PCFIN-21): Finish: Brick formliner.
3. (PCFIN-22): Finish: Concrete formliner.

E. Integral Color:

1. (PCFIN-23): Finish: Acid etched.
2. (PCFIN-24): Finish: Sandblast.
3. (PCFIN-25): Finish: Brick Formliner.
4. Basis of Design: Wells Concrete Sample ID#AA992B:
    a. Federal White PLC-700

b. Evenson 3/8 inch Pea Gravel-1907
c. Evenson Torpedo Sand - 1167
d. #0051 Sandy Buff 3%

F. Standard Float Finish (PCFIN-1): As-cast surface finish: Provide surfaces to match accepted sample or mockup units for acceptable surface air voids, sand streaks and honeycombs.

G. Acid Etch Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack. Provide joints and reveals as indicated in drawings. Architect to select final finish from manufacturer's samples.

H. Sandblast Finish: Sandblast exposed-to-view precast unit surfaces to expose aggregate. Protect adjacent surfaces. Provide joints and reveals as indicated in drawings. Architect to select final finish from manufacturer's samples.

2.04 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
1. Deformed billet-steel bars.

2.05 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Fine and Coarse Structural Aggregates: ASTM C33/C33M.

C. Lightweight Structural Aggregate: ASTM C330/C330M.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

E. Grout:
1. Non-shrink, non-metallic, minimum 10,000 psi (70 MPa), 28 day strength.

2.06 FORM LINERS

A. Basis of Design:
1. (PCFIN-21), (PCFIN-25) Urethane Formliner: #115 Old Brick by Scott Systems: www.scottystem.com.
2. (PCFIN-22) Concrete Formliner: 515-S Old Timer Form by Architectural Polymers: www.apformliner.com.

2.07 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.
2. Galvanize after fabrication in accordance with requirements of ASTM A123/A123M.
3. Items not below grade or exposed to the elements, or areas of high moisture or chemical content need not be galvanized. Coordinate with Architect.

B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563/A563M nuts and matching washers.

C. Primer: Zinc rich type.

2.08 INSULATION

A. Integral Insulation: Rigid extruded polystyrene (XPS) board insulation.

1. Design and construct panels to maintain overall R-value of 15.2 (RSI-value of 2.7), with less than one percent change due to penetrations and connections, when calculated in accordance with ASHRAE Std 90.1 I-P, isothermal planes method.

2.09 FABRICATION

A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.
B. Maintain plant records and quality control program during production of precast units. Make records available upon request.
C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.
D. Use form liners in accordance with manufacturer's instructions.
E. Place thin brick in form liner in accordance with manufacturer's instructions. Mix bricks from several cartons for uniform distribution of color variations.
F. Maintain consistent quality during manufacture.
G. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
H. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.
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.

2.10 FABRICATION TOLERANCES

A. Conform to PCI MNL-117 and PCI MNL-135.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.
B. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

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. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.
E. Weld units in place. Perform welding in accordance with AWS D1.1/D1.1M.
F. Provide non-combustible shields during welding operations.
G. Touch-up field welds and scratched or damaged primed painted surfaces.

H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.

I. Exposed Joint Dimension: 1/2 inch (12 mm). Adjust units so that joint dimensions are within tolerances.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135.

3.05 FIELD QUALITY CONTROL

A. Coordinate all field quality control with the Storm Shelter Quality Assurance Plan.

B. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Erection of loadbearing precast concrete members.

C. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

D. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

E. Testing agency will report test results promptly and in writing to Contractor and Architect.

F. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

G. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

H. Prepare test and inspection reports.

END OF SECTION

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Clay facing brick.
C. Mortar and grout.
D. Reinforcement and anchorage.
E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - 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; 2023.
B. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
C. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
D. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.
E. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
F. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
G. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.
H. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2025.
I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2017.
J. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
L. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.
M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
O. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
P. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2017.
Q. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. 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.

E. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.

1.05 MOCK-UPS

A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar, accessories, structural backup, wall openings, flashings (with lap joint, corner, and end dam), and wall insulation in mock-up.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 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 depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide nonstandard blocks configured for corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block.
   4. Nonloadbearing Units: ASTM C129.
      a. Hollow block.
   5. Patterns and Faces:
      a. (CMU-1): Manufacturer's standard color and texture.
      b. (BMU-20): Single vertical score in face(s).
         1) Basis of Design: AmCon Concrete Products: www.amconconcreteproducts.com.
         2) Color: #504 Cinnamon.
         3) Provide manufacturer's standard factory applied sealer (such as TK 192 by TK Products) on each ground surface to facilitate cleaning.
         4) Provide special units for bullnosed corners and where multiple faces are visible.
      c. Supplier of prefinished or integrally colors units shall guarantee that the finished product will not be stained or damaged due to iron or shale deposits in the face for a period of 5 years.

2.03 BRICK UNITS

A. Facing Brick (BRK-1): ASTM C216, Type FBS Smooth, Grade SW.
   1. Basis of Design: Glen-Gary.

2. Color and texture: La Salle.
3. Nominal size: Modular.
4. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

2.04 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type S.
B. Portland Cement: ASTM C150/C150M, Type I.
C. Hydrated Lime: ASTM C207, Type S.
D. Mortar Aggregate: ASTM C144.
E. Grout Aggregate: ASTM C404.
F. Water: Clean and potable.
G. 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.

2.05 REINFORCEMENT AND ANCHORAGE

A. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
   1. Environmental Product Declaration (EPD).
B. Basis of Design: Hohmann & Barnard, Inc; www.h-b.com.
C. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
   1. Blok-Lok Limited: www.blok-lok.com.
   2. WIRE-BONDwww.wirebond.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.
D. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; galvanized.
E. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
F. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Ladder.
   2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
   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.
G. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss, with adjustable ties or tabs spaced at 16 in (406 mm) on center.
   2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.

3. Size: 0.1875 inch (4.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods and adjustable components of 0.1875 inch (4.8 mm)wire, width of components as required to provide not less than 5/8 inch (16 mm) of mortar coverage from each masonry face.
4. Vertical adjustment: Not more than 1 1/4 inches (32 mm).
5. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

2.06 ACCESSORIES

A. Preformed Control Joints (CJ-1): Rubber material. Provide with corner and tee accessories, fused joints.
B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
   1. Acceptable Products: Contractor's option to achieve the specified results without damage to masonry or surrounding materials, such as Sure Klean by Prosoco or other product with similar properties.
   2. Use in strict accordance with manufacturer's written instructions.

2.07 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
B. 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).
C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
D. Mixing: Use mechanical batch mixer and comply with referenced standards.

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 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.03 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: Running.
   2. Mortar Joints: Concave.
D. Brick Units:
   1. Bond: Running.
   2. Mortar Joints: Concave.

3.04 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, except for units laid in stack bond.

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. Isolate masonry partitions from vertical structural framing members with a control joint.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.05 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE 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. Lap joint reinforcement ends minimum 6 inches (150 mm).

3.06 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. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 24 inches (600 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.

3.07 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.

1. Openings over 48 inches not scheduled: Contact Structural Engineer.

3.08 GROUTED COMPONENTS

A. Follow lap splice requirements as indicated in Structural drawings.

3.09 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.

3.10 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

B. 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.

C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - 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.

3.12 CLEANING

A. Remove excess mortar and mortar droppings.

B. Clean soiled surfaces with cleaning solution.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 042200 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Lintels.
   3. Mortar and grout materials.
   4. Reinforcement.
   5. Mortar and grout mixes.

B. Products Installed but not Furnished under This Section:
   1. Steel lintels in unit masonry.
   2. Steel shelf angles for supporting unit masonry.
   3. Cavity wall insulation adhered to masonry backup.

C. Related Requirements:
   1. Section 031000 "Concrete Forms and Accessories" for dovetail or channel slots for masonry-veneer anchors.
   2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.02 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).
B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For the following:
   1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R. Indicate elevations of reinforced walls.

1.05 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Material Certificates: For each type of the following:
   1. Masonry units.
      a. Include data on material properties.
      b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
      d. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.

C. Qualification Statements: For testing agency.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.06 QUALITY ASSURANCE

A. Qualifications:
1. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.08 FIELD CONDITIONS

A. Protection of Masonry: During construction, 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.
1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three 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.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain exposed masonry units of a uniform texture and color, or a uniform blend within ranges accepted for these characteristics, from single source or manufacturer for each product required.

B. For exposed masonry units and cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.02 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.

2.03 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units above standard square-edge CMU first course at outside corners, end of walls, at door and window jambs and heads, and as indicated on Drawings.

B. CMUs: ASTM C90, normal weight unless otherwise indicated.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3250psi.
   2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
   3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.04 LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.05 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

G. Water: Potable.

2.06 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Dur-O-Wal; a Hohmann & Barnard Company; D/A 810, D/A 812, or D/A 817.
    b. Heckmann Building Products, Inc., No. 376 Rebar Positioner.
    c. Hohmann & Barnard, Inc., #RB or #RB-Twin Rebar Positioner.
    d. Wire-Bond, O-Ring or Double O-Ring Positioner.
    e. Or Approved Equal.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.07 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2500 psi.

3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
   3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
   5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 8-inch horizontal face dimensions at corners or jambs.
C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.

3.05 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:
   1. Bed face shells in mortar and make head joints of depth equal to bed joints.
   2. Bed webs in mortar in all courses of piers, columns, and pilasters.
   3. Bed webs in mortar in grouted masonry, including starting course on footings.
   4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
   5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.06 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
   1. Individual Metal Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
   2. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.

3. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.
4. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement.
    c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.
5. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

3.07 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
    1. Space reinforcement not more than 16 inches o.c. unless noted otherwise in wall schedule.
    2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
    3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
C. Provide continuity at wall intersections by using prefabricated T-shaped units.
D. Provide continuity at corners by using prefabricated L-shaped units.
E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
B. Form control joints in concrete masonry using one of the following methods:
    1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
    2. Install preformed control-joint gaskets designed to fit standard sash block.
    3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.

3.09 LINTELS

A. Install steel lintels where indicated.
B. Provide masonry or lintels where indicated and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are indicated without structural steel or other supporting lintels.
C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.010 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
    1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
    2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
B. Placing Reinforcement: Comply with requirements in TMS 602.
C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.011 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engagea qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with Level 2 in TMS 402.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for compressive strength.

F. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

3.012 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.013 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 051200 – STRUCTURAL STEEL FRAMING

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. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:
1. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
2. Section 099123 "Interior Painting" for painting requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
1. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

5. Identify members not to be shop primed.

C. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Mill test reports for structural-steel materials, including chemical and physical properties.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Special inspections of the steel fabrication are required in accordance with “International Building Code” Section 1704.2 unless the steel fabrication is done by an approved steel fabr

B. icator in accordance with “International Building Code” Section 1704.2.2.

C. AISC Certified Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU.

1. The following fabricator is certified in the State of Minnesota. Certified fabricators not listed may also bid on the Project, see AISC Certified fabricator’s list for all listings.

    a. Ben’s Structural Fabrication, Waite Park, MN.

D. Non AISC Certified: In lieu of AISC certification provide the following:

1. Submit letter to building official to review fabricator’s ability to fabricate steel, with a copy to the Architect. Letter shall, at a minimum, identify the following:

    a. Provide written procedural and quality control manuals.
    b. Provide audits of fabrication practiced by an approved special inspection agency.
    c. Provide a statement that steel will be fabricated in accordance with the AISC quality certification program. If in-plant special inspection is used, refer to subparagraph “e”.

        1) Identify new requirements in current quality control procedures that occur.
        2) Submit a certificate of compliance to the building official and Architect that work completed meets AISC quality requirements and conforms to the contract documents.

    d. In lieu of subparagraph “c”, fabricator to provide in-plant special inspections as required by IBC and by AISC.

1) Identify special inspection agency to provides service

2) Submit special inspection reports to the building official (with copies to the Architect).

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
1. Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.

a. Select and complete connections using schematic details indicated and ANSI/AISC 360.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles-Shapes: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct Tension Indicators (where SC type connection is secified): ASTM F959, Type 325-1, compressible washer type with plain finish.

2.4 PRIMER

A. Steel Primer:

1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.5 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 3.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: An independent testing agency will perform source quality control tests as required by IBC Chapter 17.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

a. In addition to visual inspection, test and inspect full penetration field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1) Liquid Penetrant Inspection: ASTM E165/E165M.
2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

3) Ultrasonic Inspection: ASTM E164.
4) Radiographic Inspection: ASTM E94/E94M.

3.6 PROTECTION

A. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel joists and joist girders.
2. Primers.
3. Steel joist accessories.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.
3. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.02 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

C. Delegated Design Submittals: For steel joist framing, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Mill Certificates: For each type of bolt.

D. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

E. Field quality control reports.

F. Delegated Design Engineer Qualifications: For steel joist framing.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications.

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Erector Qualifications: An experienced Erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

D. Welding Qualifications: Qualify field-welding procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications**.**

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.07 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

1. Use ASD; data are given at service-load level.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:

    a. Roof Joists: Vertical deflection of 1/360 of the span.

2.02 STEEL JOISTS AND JOIST GIRDERS

A. K-Series Steel Joist: Manufactured steel joists of type indicated in accordance with "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists.
2. K-Series Steel Joist Substitutes: Manufactured in accordance with "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
3. Provide holes in chord members for connecting and securing other construction to joists.
4. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."
5. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends as indicated on Drawings, complying with SJI's "Specifications."
6. Camber joists in accordance with SJI's "Specifications.".
7. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.03 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
2. Provide shop primer that complies with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

2.04 STEEL JOIST ACCESSORIES

A. Bridging:

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
2. Detail and fabricate in accordance with SJI's "Specifications ." Furnish additional erection bridging if required for stability.
3. Fabricate as indicated on Drawings and in accordance with SJI's "Specifications ." Furnish

additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings. Shop prime paint.

C. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.

1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.
2. Finish: Plain, uncoated

E. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563/A563M, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain.

F. Welding Electrodes: Comply with AWS standards.

G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.05 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF STEEL JOISTS AND JOIST GIRDERS

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction in accordance with SJI's "Specifications ," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.03 REPAIRS

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting:

1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists , bearing plates, abutting structural steel, and accessories.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool

cleaning.

b. Apply a compatible primer of same type as primer used on adjacent surfaces.

2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds in accordance with AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

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. Roof deck.
   2. Acoustical roof deck.
   3. Noncomposite form deck.

B. Related Requirements:
   1. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
   2. Division 09 painting Sections for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated, including noise reduction coefficients.

B. Shop Drawings:

   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

   1. Power-actuated mechanical fasteners.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Canam United States; Canam Group Inc.
   2. New Millennium Building Systems, LLC.
   3. Nucor Corp.; Vulcraft Group.
   4. Verco Manufacturing Co.

2.3 ACOUSTICAL ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Toris 5.5A Acoustical by Epic Metals, Rankin, PA, or approved equal.

C. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Gray top surface with white underside.
   2. Deck Profile: As indicated.
   3. Profile Depth: 5.5 inches.
   4. Design Uncoated-Steel Thickness: As indicated.
   5. Span Condition:: Triple span or more.
   6. Side Laps: Interlocking seam.
   7. Acoustical Perforations: Deck units with manufacturer's standard perforated bottom.
   8. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber. Sound-absorbing insulation shall be provided for installation above the perforated holes in the bottom flat area between the dovetail-shaped ribs. To facilitate field painting of the

perforated surfaces, the sound absorbing elements shall be supported above the surface on corrosion resistant spacers. Sound absorbing elements and spacers shall be factory installed.

9. Acoustical Performance: NRC 1.0, tested according to ASTM C 423.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Wedge bolt hanging devices (Toris Deck) or Ankore hanging devices (with included locks) shall be installable and relocatable along the length of the interior ribs of the Acoustical Roof Deck panels. Manufacturer’s product data shall be consulted for minimum spacing, load capacities, and proper installation procedure.

E. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

F. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

I. Galvanizing Repair Paint: ASTM A 780.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ACOUSTIC ROOF DECK INSTALLATION

A. Before Installation the supporting frame and other work relating to the Acoustic Roof Deck shall be examined to determine if this work has been properly completed.

B. Before being permanently fastened, Acoustical Roof Deck panels shall be placed with ends accurately aligned and adequately bearing on supporting members. Proper coverage of the Acoustical Roof Deck panels shall be maintained. Care must be taken by the erector to maintain uniform spacing of the bottom rib opening (equal to the opening in the profiled sheet) at the sidelaps. Consistent coverage shall be maintained so that panels located in adjacent bays will be properly aligned.

C. Fasten roof-deck panels to steel supporting members as indicated on drawings.:

D. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on drawings.

E. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints:
    a. Butted (acoustic deck)
    b. Lapped (standard roof deck)

F. Miscellaneous Roof-Deck Accessories: Install finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation as indicated by supplier.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members as indicated on drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated on drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches , with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: An independent testing agency will perform field quality control tests as specified in section 01 4533 Code-Required Special Inspections and Procedures.

B. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

A. Construction loads that could damage the deck, such as heavy concentrated loads and impact loads shall be avoided.

B. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09.

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exterior non-load-bearing wall framing.

B. Related Requirements:

   1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of code-compliance certification for studs and tracks.

C. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings (normal wind load only).
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height .

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

4. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G90 for exterior wall applications.

B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (G90 for exterior wall applications).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1 5/8 inches.

B. Zee Sections: Manufacturer's standard Z-shaped steel girt sections, of web depths indicated, and as follows:

1. Minimum Base-Metal Thickness: as indicated.
2. Flange Width: 2 1/2 inches.

C. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

D. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

E. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.

2. Flange Width: 1 inch plus twice the design gap for other applications.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C .

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.7 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

C. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to infill studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 FIELD QUALITY CONTROL

A. Testing: An independent testing agency will perform field quality control tests as specified in section 01 4533 Code-Required Special Inspections and Procedures..

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Miscellaneous framing and supports.
   2. Metal bollards.
   3. Vehicular barrier cable systems.
   4. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
   3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:
   1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
   2. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.

1.02 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

A. Product Data:
   1. Fasteners.
   2. Shop primers.
   3. Shrinkage-resisting grout.
   4. Slotted channel framing.
   5. Manufactured metal ladders.
   6. Metal bollards.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
   1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.

2. Metal ladders.
3. Metal bollards
4. Loose steel lintels.

1.04 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
B. Welding certificates.
C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
D. Research Reports: For post-installed anchors.
E. Delegated design engineer qualifications.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.06 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance of Aluminum Ladders: Ladders, including landings, are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.
B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
E. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
F. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

2.03 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless steel fasteners for fastening aluminum.
B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

G. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.04 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.05 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.07 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.08 METAL LADDERS

A. General:
1. Comply with ANSI A14.3.

B. Aluminum Ladders:
   1. Basis-of-Design Product: The design is based on the following:
   2. O'Keeffe's Inc., Model 500. (Interior wall mounted ladder to roof hatch)
   3. O'Keeffe's Inc., Model 503. (Exterior wall mounted ladder from low roof to gym roof)

C. Subject to compliance with requirements, provide named product or comparable product by one of the following:
   1. Halliday Products.
   2. Precision Ladders, LLC.

D. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
   1. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.
   2. Model 500: Provide standard floor mounted bracket with intermediate wall brackets as required.
   3. Model 503: Provide off floor mounting brackets, each access ladder.

2.09 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

2.010 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

2.011 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.012 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.013 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
   5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

F. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.014 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Extruded Aluminum: Two coats of clear lacquer.

3.02 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor shelf angles securely to existing construction with expansion anchors

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.03 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.04 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.05 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.06 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
2. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
3. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 05 5133 - METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop-fabricated metal ladders.
B. Prefabricated ladders.
C. Prefabricated ship ladders.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
F. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.
G. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.
H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
J. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).
K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
L. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings:
    1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
    2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.
B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
C. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
D. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B211/B211M, 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6061 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

E. Bolts, Nuts, and Washers: Stainless steel.

F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 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. 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.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 PREFABRICATED LADDERS

A. Prefabricated Ladder (LADDER-1): 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: Aluminum; 6063 alloy, T52 temper.
3. Finish: Mill finish aluminum.
4. Manufacturers:
    a. O'Keeffe's Inc: Model 503: www.okeeffes.com.
    b. Substitutions: See Section 01 6000 - Product Requirements.

B. Prefabricated Ship Ladder (SHIP LADDER-1#): 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: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
3. Incline: 60 degrees.
4. Treads: Minimum 6 inches deep and 18 inches wide.
5. Risers: Maximum 9-1/2 inches high.
6. Handrail: Between 30 and 34 inches high as measured from tread nosing.
7. Finish: Mill finish aluminum.
8. Manufacturers:
    a. O'Keeffe's Inc; Model 523A: www.okeeffes.com.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 FINISHES - STEEL

A. Prime paint steel items.

1. Do not prime surfaces in direct contact with concrete.
2. Do not prime surfaces where field welding is required.

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.

2.06 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Interior Aluminum Surfaces: Class I natural anodized.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

2.07 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 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.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, 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 5305 - METAL GRATINGS AND FLOOR PLATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed metal mezzanine and stair tread gratings.

B. Flat surface floor and stair tread plating.

C. Perimeter closure.

1.02 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 A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2025).

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

H. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide span and deflection tables.

C. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Manufacturer's Installation Instructions: Indicate special requirements for opening and perimeter framing.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design gratings and plates under direct supervision of a licensed Professional Engineer experienced in design of this type of work.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Design Live (Pedestrian) Load: Uniform load of 100 lb/sq ft (4.7 kPa) minimum; concentrated load of 300 lbs (1330 N).

B. Maximum Allowable Deflection Under Live Load: 1/240 of span; size components by single support design.

C. Maximum Spacing Between Bars: To restrict pedestrian shoe heels.

2.02 MATERIALS

A. Metal Grating System (MET FAB-30): Cold rolled carbon steel:

1. Basis of Design: Steel grating 19W4: 3/4 inch deep with 1/8 inch thick bearing bars. Cross rods at 4 feet on center. 80% open area.

B. Steel Floor Plate: ASTM A786/A786M; manufacturer's standard pattern.

C. Steel For Welding or Riveting: ASTM A36/A36M unfinished, of shapes indicated.

D. Steel Framing: ASTM A36/A36M shapes, unfinished.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.03 ACCESSORIES

A. Perimeter Closure: Of same material as grating.

2.04 FABRICATION

A. Fabricate grates and plates to accommodate design loads.

B. Fabricate support framing for openings.

C. Top Surface: Serrated.

2.05 FINISHES

A. Prepare surfaces to be primed in accordance with SSPC-SP 2.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Do not prime surfaces in direct contact with concrete or where field welding is required.

D. Prime paint items with one coat.

E. Galvanizing for Steel Shapes: ASTM A123/A123M.

F. Galvanizing for Steel Hardware: ASTM A153/A153M.

G. Non-Slip Surfacing: Aluminum oxide.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on drawings.

B. Verify that opening sizes and dimensional tolerances are acceptable.

C. Verify that supports are correctly positioned.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Place frames in correct position, plumb and level.

C. Mechanically cut galvanized finish surfaces. Do not flame cut.

D. Anchor by welding.

E. Set perimeter closure flush with top of grating and surrounding construction.

F. Secure to prevent movement.

END OF SECTION

SECTION 05 7000 - DECORATIVE METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Railing and guardrail assemblies.

B. Wall-mounted handrails.

1.02 REFERENCE STANDARDS

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

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.

E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

1.03 SUBMITTALS

A. See Section 01 3000 - 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 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. Maintenance Data: Manufacturer's instructions for care and cleaning.

E. Executed warranty.

1.04 QUALITY ASSURANCE

A. Templates: Supply installation templates, reinforcing, and required anchorage devices.

1.05 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 and unrepairable materials. Ensure replacement materials are indistinguishable from undamaged parts and finishes.

D. Prior to installation, store materials and components under cover in a dry location.

1.06 FIELD CONDITIONS

A. 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 installation.

1.07 WARRANTY

A. Manufacturer Warranty: Provide 2-year manufacturer warranty for defects in materials, fabrication, finishes, and installation. Complete forms in St. Cloud School District 742's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.

B. 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.
      a. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
      b. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
   3. Welding Materials: Comply with AWS D1.1/D1.1M.

C. Stainless Steel Components:
   1. Section, Plates: ASTM A666/A666M, Type 304.
   2. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

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. Metal Railing (GUARD-#): Engineered, post-supported railing system.

1. Configuration: See drawings for shapes, sizes and materials.

C. Wall-Mounted Handrail (RAIL-2):
   1. 1-1/2 inch (38 mm) diameter steel, field painted.
   2. Handrail Brackets: Manufacturer's standard steel brackets.
      a. Finish: Steel, field painted.
   3. Comply with ADA Standards.

D. Floor-Mounted Handrail (RAIL-1):
   1. 1-1/2 inch (38 mm) diameter painted steel.
   2. See drawings for anchoring requirements at floor.
   3. Comply with ADA Standards.

2.03 ACCESSORIES

A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

B. Anchors and Fasteners: Provide anchors, fasteners, and other attachment devices required to attach to structure. Ensure attachment devices are of same material as components unless indicated otherwise.

C. 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.

D. Carbon Steel Bolts and Nuts: ASTM A307.

E. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 0.015 inch (0.4 mm) dry film thickness per coat.

F. Finish Touch-Up Materials: As recommended by manufacturer for field application.

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 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. 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.

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

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.
B. Structural composite lumber framing.
C. Rough opening framing for doors, windows, and roof openings.
D. Sheathing.
E. Roof-mounted curbs.
F. Preservative treated wood materials.
G. Miscellaneous framing and sheathing.
H. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.
E. ITS (DIR) - Directory of Listed Products; current edition.
F. PS 1 - Structural Plywood; 2023.
G. PS 2 - Performance Standard for Wood Structural Panels; 2019.
H. PS 20 - American Softwood Lumber Standard; 2025.
I. SPIB (GR) - Grading Rules; 2014.
J. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 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. Wood sourced from a sustainably harvested location. Submit any documentation available.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring (WD BLKG):

1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.

1. (WD SHTG-30): 1/2 inch.
2. (WD SHTG-30F): 1/2 inch; fire retardant treated.
3. (WD SHTG-31): 5/8 inch.
4. (WD SHTG-31F): 5/8 inch fire retardant treated.
5. (WD SHTG-32): 3/4 inch.
6. (WD SHTG-32F): 3/4 inch fire retardant treated.

B. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
3. Other Locations: PS 1, C-D Plugged or better.

2.04 FIRE-RETARDANT TREATMENT (FRT)

A. Products:

1. Arxada; Dricon FS: www.arxada.com/#sle.
2. Lonza Group: www.wolmanizedwood.com/#sle.
3. Hoover Treated Wood Products, Inc: www.frtw.com/#sle.
4. Koppers, Inc: www.koppersperformancechemicals.com/#sle.
5. T2EARTH, LLC; OnWood: www.t2earth.com/#sle.
6. UFP Industries; ProWood FR Lumber: www.ufpi.com/#sle.
7. Viance, LLC; D-Blaze: www.treatedwood.com/#sle.
8. Substitutions: See Section 01 6000 - Product Requirements.

B. Factory-treat wood members in accordance with AWPA U1 and use category indicated.

C. Fire-Retardant Treatment: Interior Type A, Use Category UCFA (HT), High Temperature.

1. Treat wood and plywood used in roof framing and attic spaces.

D. Kiln-dry after treatment (KDAT) to maximum moisture content of 19 percent for sawn material and 15 percent for plywood.

E. Fabrication of FRT Wood:

1. Ripping or milling of boards, lumber, and timber after treatment is not permitted.
2. Field cutting to length and drilling of holes in boards, lumber, and timber are permitted without additional treatment.
3. Field cutting and drilling of holes in plywood are permitted.

F. Label or brand FRT wood with classification mark of UL (DIR) or ITS (DIR) or other approved inspection agency, the treatment plant, name of treatment, species of wood, flame spread and smoke developed index, method of drying after treatment, and treating standard.

2.05 ACCESSORIES

A. Metal and Finish of Fasteners:
   1. Fire-Retardant-Treated Wood:
      a. Nails, timber rivets, wood screws, and lag screws: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
   2. High Humidity Wood Locations: Hot-dip galvanized steel complying with ASTM A153/A153M.
   3. Untreated Wood: Unfinished steel.

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 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.

3.03 CLEANING

A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

1.02 RELATED REQUIREMENTS

A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet substrate and finish.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 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 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets (PLAM-#):

1. Basis of Design: See drawings for product information.
2. Finish - Exposed Exterior Surfaces: Decorative laminate.
3. Finish - Exposed Interior Surfaces: Decorative laminate.
4. Finish - Semi-Exposed Surfaces: Decorative laminate
5. Finish - Concealed Surfaces: Manufacturer's option.
6. Door and Drawer Front Edge Profiles: Square edge with thick applied band.
7. Casework Construction Type: Type A - Frameless.

8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
9. Layout for Cabinet and Door Fronts: Flush panel.
10. Adjustable Shelf Loading: 40 psf (19.5 gm/sq cm).
    a. Deflection: L/144.

C. Hook (HK-2):
1. Basis of Design: As indicated on drawings.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.
B. Wood sourced from a sustainably harvested location. Submit any documentation available.
C. Provide composite wood containing no added formaldehyde. See Section 01 6116.

2.03 PANEL CORE MATERIALS

A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
1. Grade: M-2; moisture resistance: MR10.

2.04 THERMALLY FUSED LAMINATE PANELS

A. Thermally Fused Laminate (TFL): Melamine-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
1. Panel Core Substrate: Particleboard.

2.05 LAMINATE MATERIALS (PLAM-#)

A. Manufacturers:
1. Formica Corporation: www.formica.com.
2. Panolam Industries International, Inc: www.panolam.com/#sle.
3. Wilsonart LLC: www.wilsonart.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. See drawings for (PLAM-#) finish.

C. Provide specific types as follows:
1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness.
2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness.
3. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness.
4. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 COUNTERTOPS

A. Countertops: See Section 12 3600.

2.07 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
B. Plastic Edge Banding: Extruded 3 mm PVC, flat shaped; smooth finish; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's standard range.

C. Fasteners: Size and type to suit application.
D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.
   1. Grommet Locations: As indicated on drawings.

2.08 HARDWARE

A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades indicated below:
   1. Hardware Types: As indicated on drawings.
   2. Product Grade: As required by specified woodworking quality grade.
B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).
D. Hook (HK-2):
   1. Basis of Design: As indicated on drawings.
E. Drawer Slides:
   1. Type: Full extension with overtravel.
   2. Static Load Capacity: Heavy Duty grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.
   6. Manufacturers:
      a. Accuride International, Inc: www.accuride.com.
      b. Grass America Inc: www.grassusa.com.
      c. Hettich America, LP: www.hettich.com.
      d. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.
F. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
   1. Manufacturers:
      a. Blum, Inc: www.blum.com/#sle.
      b. Grass America Inc: www.grassusa.com/#sle.
      c. Hardware Resources: www.hardwareresources.com.
      d. Hettich America, LP: www.hettich.com/sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.09 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. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
D. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) 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.

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 4200 - WOOD PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom wood veneer paneling.

1.02 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, U.S. Version 3.1; 2016, with Errata (2017).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on fire-retardant treatment materials and application instructions.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

B. Do not deliver wood materials to project site until building is fully enclosed and interior temperature and humidity are in accordance with recommendations of AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

PART 2 PRODUCTS

2.01 PANELING

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

B. Slotted Wood Paneling (SLTPNL-#)

1. Basis of Design: See drawings for product information.
2. Hardware: Provide the following hardware with slotted wood panel system.
    a. 8 inch long slatwall hooks. Chrome finish. Qty-25.
    b. 4 inch long pegs: Qty-25.
    c. Acrylic Hoisery Bins: Qty-12.

C. Flat Paneling (WDP-#):

1. Basis of Design: See drawings for product information.
2. Panels: Veneer of full width and balanced sequence matched.
3. Visible Edges and Reveals: Filled and painted.
4. Outside Corners: Mitered and splined.

2.02 WOOD-BASED MATERIALS - GENERAL

A. Wood sourced from a sustainably harvested location. Submit any documentation available.

2.03 FABRICATION

A. Prepare panels for delivery to site, permitting passage through building openings.

B. Finish exposed edges of panels as specified by grade requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Do not begin installation until wood materials have been fully acclimated to interior conditions.

C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.

D. (WDP-#) panels to be installed with finish nails in quantity and spacing required to fully anchor to substrate. Fill nail holes with putty to match. See drawings for locations where (WDP-#) panels are to be installed on a z-clip hanger system.

END OF SECTION

SECTION 06 8316 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.02 REFERENCE STANDARDS

A. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

B. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

D. FDA Food Code - Chapter 6 - Physical Facilities; Current Edition.

E. FM 4880 - Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2022.

1.03 SUBMITTALS

A. See Section 01 3000 - 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. Samples: Submit two samples 6 by 6 inch (150 by 150 mm) in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:

1. Valto Engineered Materials; Glasbord: www.valtoem.com.
2. Marlite, Inc; Standard FRP: www.marlite.com.
3. Nudo Products, Inc; FiberLite FRP: www.nudo.com.
4. Panolam Industries International, Inc: www.panolam.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

A. Wall Panels (FRP-#):

1. Basis of Design: As indicated on drawings.
2. Attachment Method: See drawings for trim and sealant locations.

B. Wall Panels (WP-#)

1. Basis of Design: As indicated on drawings.
2. Attachement Method: Adhesive only for large swings in relative humidity. See drawings for trim and sealant locations.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Class 1 fire rated when tested in accordance with FM 4880.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   4. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.

B. Trim: As indicated on drawings.

C. Adhesive: Type recommended by panel manufacturer.
   1. (WP-1): Type recommended by panel manufacturer for large swings.

D. Sealant: Type recommended by panel manufacturer; white.
   1. (WP-1): Type recommended by panel manufacturer for large swings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 07 1900 - WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior and interior, masonry and concrete surfaces.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

1.05 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

1.06 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 40 degrees F (4 degrees C) or higher than 110 degrees F (43 degrees C).

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide one year manufacturer warranty for manufacturing defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:

1. BASF Construction Chemicals: www.basf.com.
2. Concrete Sealers USA: www.concretesealersusa.com.
3. Pecora Corporation: www.pecora.com.
4. PROSOCO, Inc: www.prosoco.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Water Repellent (REPEL-1): Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.

1. Applications: As indicated on Drawings.
2. Number of Coats: Two.
3. VOC Content: See Section 01 6116.
4. Moisture Absorption When Applied to Concrete: Two percent, maximum, when tested in accordance with ASTM C642 concrete sample completely coated with water repellent.
5. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.
    a. Basis of Design:
        1) PROSOCO, Inc; Sure Klean Weather Seal Siloxane PD: www.prosoco.com/#sle.
        2) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. 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. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
B. Do not start work until concrete substrate is cured to 80% of design strength.
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.

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.

END OF SECTION

SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind exterior wall finish.

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 RELATED REQUIREMENTS

A. Section 07 2600 - Vapor Retarders: Separate vapor retarder materials.

B. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

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; 2024.

E. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2024.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer’s listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
   1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
      a. (INSUL-1): Type IV, 25 psi. Provide drainage channels.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
   5. Board Edges: Square.
   6. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
      a. Environmental Product Declaration (EPD).
      b. Health Product Declaration (HPD).
   7. Basis of Design: Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.
   8. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
      a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MINERAL FIBER BOARD INSULATION MATERIALS

A. Mineral Wool Block, Board, or Blanket Thermal Insulation: Complying with ASTM C612 or ASTM C553.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Thermal Resistance: R-value (RSI-value) of 4.2 (0.74) per inch at 75 degrees F (24 C), minimum, when tested according to ASTM C518.
   3. Maximum Density: 8 pcf (128 kg/cu m), nominal.
   4. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
      a. Environmental Product Declaration (EPD) or Declare Label.
      b. Living Building Challenge Red List Free or Compliant.
      c. Health Product Declaration (HPD).
   5. (INSUL-26) Basis of Design: Thermafiber, Inc; RainBarrier: www.thermafiber.com.
   6. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
      a. ROCKWOOL; CAVITYROCK: www.rockwool.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Sheet Vapor Retarder: See Section 07 2600.
B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
C. Insulation Fasteners: Appropriate for purpose intended.
D. Adhesive: Type recommended by insulation manufacturer for application.

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. Install boards horizontally on foundation perimeter.

1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Extend boards over expansion joints, unbonded to foundation on one side of joint.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards vertically on walls.

1. Butt edges and ends tightly to adjacent boards and protrusions.

B. Extend boards over expansion joints, unbonded to wall on one side of joint.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.

B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

A. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2025.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

D. ASTM 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 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, insulation properties, and preparation requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of experience.

B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years experience.

1.05 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.

PART 2 PRODUCTS

2.01 MATERIALS

A. Foamed-In-Place Insulation (INSUL-36): Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
2. Products:
    a. BASF Corporation; SPRAYTITE 81206: www.spf.basf.com.
    b. Enverge; NexSeal: www.envergesprayfoam.com.
    c. Henry, a Carlisle Company; PERMAX 2.0: www.henry.com/#sle.
    d. Johns Manville; JM IV HFO Closed-cell: www.jm.com/#sle.
    e. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

1. Coating Type: Single component, water-based.
2. Protected Insulation Type: Spray polyurethane foam (SPF).
3. Application: Apply using brush, roller, or airless sprayer.
4. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
5. Color: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.

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.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 2600 - VAPOR RETARDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vapor retarders.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with vapor retarders.

1.03 DEFINITIONS

A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.

B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F (23 degrees C) and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:

1. Class I: 0.1 perm or less.
2. Class II: Greater than 0.1 perm to 1.0 perm.
3. Class III: Greater than 1.0 perm to 10 perms.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. 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 E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

D. ICC (IBC)-2018 - International Building Code; 2018.

E. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017, with Editorial Revision (2021).

1.05 SUBMITTALS

A. See Section 01 3000 - 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.

E. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 VAPOR RETARDERS

A. Underslab Vapor Retarders: See Section 03 3000.

B. (VPR RET-10): Contractor's option to provide a self-adhesive or liquid applied membrane as described in the following paragraphs:

1. Vapor Retarder, Self-Adhering Membranes (VPR RET-10): Rubberized asphalt bonded to aluminum foil facer.
    a. Thickness: 40 mil, 0.04 inch (1.0 mm), nominal.
    b. Vapor Retarder Class I: 0.1 perm (5.72 ng/(Pa s sq m)) or less, when tested in accordance with ASTM E96/E96M, Procedure A.
    c. Nail Sealability: Passed nail sealability test in accordance with ASTM D1970/D1970M.
    d. System Accessory Products: As recommended by membrane manufacturer.
    e. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
        1) Environmental Product Declaration (EPD) or Declare Label.
        2) Living Building Challenge Red List Free or Compliant.
    f. Basis of Design: Henry Company; Blueskin SA LT (Low Temp): www.henry.com/#sle.
    g. Other Acceptable Products provided they meet or exceed the Basis of Design performance:
        1) Carlisle Coatings and Waterproofing; Fire Resist 705FR-A: www.carlisleccw.com/#sle.
        2) GCP Applied Technologies; Perm-A-Barrier Low Temperature Wall Membrane: www.gcpat.com.
        3) W. R. Meadows, Inc; Air-Shield: www.wrmeadows.com/#sle.
        4) Substitutions: See Section 01 6000 - Product Requirements.
2. Vapor Retarder Coating (VPR RET-10): Liquid applied, resilient, ultra-violet (UV) light resistant coating; associated joint treatment.
    a. Water Vapor Permeance: 1.0 perm (57 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.
    b. VOC Content: Less than 6.68 oz/gal (50 g/L), when tested in accordance with 40 CFR 59, Subpart D - EPA Method 24.
    c. Suitable for use on concrete, masonry, plywood, and gypsum sheathing.
    d. Joint Preparation Treatment: Provide coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
    e. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.
    f. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
        1) Environmental Product Declaration (EPD).
        2) Health Product Declaration (HPD).
    g. Basis of Design: Henry Company; Air-Bloc 16MR: www.henry.com/#sle.

h. Other Acceptable Products provided they meet or exceed the Basis of Design performance, including sustainability requirements:
    1) Carlisle Coatings and Waterproofing; Fire Resist Barritech NP: www.carlisleccw.com/#sle.
    2) GCP Applied Technologies; Perm-A-Barrier NPL 10 LT: www.gcpat.com.
    3) W. R. Meadows, Inc; Air-Shield LSR: www.wrmeadows.com/#sle.
    4) Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.

B. Sealant for Cracks and Joints in Substrates: Resilient elastomeric joint sealant compatible with substrates and vapor retarder materials.
    1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
    2. All flashing materials shall be compatible with, and approved by, the membrane manufacturer.

C. Flexible Flashing: Self-adhering or mechanically-attached flashing used for wall penetrations in accordance with ICC-ES AC148 requirements.

D. Thinners and Cleaners: As recommended by vapor retarder manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

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. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Mechanically Fastened Sheets - Vapor Retarder On Exterior:
    1. Install sheets shingle fashion to shed water, with seams generally horizontal.
    2. Overlap seams as recommended by manufacturer, 6 inches (152 mm), minimum.
    3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches (305 mm), minimum.
    4. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
    5. Where stud framing rests on concrete or masonry substrate, extend lower edge of vapor retarder sheet at least 4 inches (102 mm) below bottom of framing and seal to substrate with sealant or approved mounting tape.
    6. Install vapor retarder underneath jamb flashings.

7. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

E. Mechanically Fastened Sheets - Vapor Retarder On Interior:
   1. When insulation is installed within assembly, install vapor retarder over insulation.
   2. Anchor to wood framing using large-headed nails or staples at 12 to 18 inches (305 to 460 mm) on center along each framing member covered; cover fasteners with seam tape.
   3. Anchor to metal framing using seam tape, adhering at least one-half of tape width to metal substrate.
   4. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, providing an airtight seal.
   5. Locate laps at framing members; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet in shingle fashion to shed water.
   6. Seal entire perimeter to structure, window and door frames, and other penetrations.
   7. Where conduits, pipes, wires, ducts, outlet boxes, and other items are installed within insulation cavity, pass vapor retarder sheet behind these items and over insulation to maintain airtight seal.

F. Self-Adhered Sheets:
   1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
   2. Lap sheets shingle fashion to shed water and seal laps airtight.
   3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
   4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.
   5. At expansion joints, provide transition to joint assemblies approved by sheet manufacturer.

G. Vapor Retarder Coatings:
   1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
   2. Where exterior masonry veneer is being installed, install masonry anchors before installing vapor retarder over masonry; provide airtight seal around anchors.
   3. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch (6 mm) along coating seams, rough cuts, and as recommended by manufacturer.
   4. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.

H. Openings and Penetrations in Exterior Vapor Retarders:
   1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches (127 mm) onto vapor retarder and at least 6 inches (152 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 vapor retarder 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 vapor retarder extending at least 2 inches (50 mm) beyond face of jambs; seal vapor retarder to flashing.
   5. At interior face of openings, seal gaps between window/door frame and rough framing using appropriate joint sealant over backer rod.

6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of vapor retarder.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. St. Cloud School District 742's Inspection and Testing: Cooperate with St. Cloud School District 742's testing agency.

1. Allow access to work areas and staging.
2. Notify St. Cloud School District 742's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
3. Do not cover work of this section until testing and inspection is accepted.

C. Obtain approval of installation procedures from vapor retarder manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

D. Take digital photographs of each portion of installation prior to covering up vapor retarders.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 4213.19 - INSULATED METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled metal panel system for walls and soffits, with trim, related flashings and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Stud wall framing system.
B. Section 05 5000 - Metal Fabrications: Weathered steel panels.
C. Section 07 6200 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
B. 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).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide manufacturer documentation on tested structural, thermal, and fire resistance capabilities of assembled panel.
C. Shop Drawings: Indicate dimensions, panel profile and layout, and methods of anchorage.
D. Samples: Submit two samples of panel, 6 by 6 inch (150 by 150 mm) in size illustrating finish color, sheen, and texture.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
B. Store pre-finished material off ground with weather protection to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
C. Prevent contact with materials that could cause discoloration or staining.

1.07 WARRANTY

A. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in St. Cloud School District 742's name and register with warrantor.
B. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal plate wall panels. Complete forms in St. Cloud School District 742's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Insulated Metal Wall Panels:

1. ATAS International, Inc: www.atas.com.
2. Centria, a Nucor Company: www.centria.com.
3. Kingspan Insulated Panels: www.kingspan.com.
4. Metl-Span, a Nucor Company: www.metlspan.com.
5. MBCI: www.mbci.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE / DESIGN CRITERIA

A. Metal Panel System: Factory-assembled metal panel system, with trim, related flashings and accessory components.
   1. Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   2. Accommodate tolerances of building structural framing.

B. Performance Requirements:
   1. Thermal Performance: K-factor of 0.140 maximum.
   2. Structural Performance: Design and size to withstand all dead loads and wind loads caused by positive and negative wind pressure acting normal to plane of panel.
      a. Verify structural performance in accordance with ASTM E330/E330M, using test pressure 1.5 times design wind pressure, with 10 seconds duration of maximum load.
   3. Movement: Accommodate the movement caused by the following without damage to system, components, or deterioration of seals:
      a. Normal movement between system components.
      b. Seasonal temperature cycling.
      c. Deflection of structural support framing,

2.03 COMPONENTS

A. Fire Rated Wall Panels: Exterior and interior metal sheet skin, factory-assembled, with foamed in place insulation; exterior and interior sheet interlocking at edges, fitted with continuous gaskets.
   1. Basis of Design: Kingspan Insulated Panels:
      a. (MTL PNL-30): QuadCore KS.
      b. (MTL PNL-31): K-Roc HF; 2 hour Fire Rating.

B. Profile: Shadowline; vertical panels.

C. Exterior Sheet: Pre-finished galvanized steel, 22 gauge, 0.0299 inch (0.76 mm) minimum base metal thickness; stucco embossed.

D. Interior Sheet: Galvanized steel, pre-finished, 22 gauge, 0.0299 inch (0.76 mm) minimum base metal thickness.

E. Panel Edge Profile: Tongue and groove, for flush seam.

F. Fabricate panels in longest practicable lengths.

G. Exterior Finish: Polyvinylidene fluoride (PVDF) coating; color as selected from manufacturer's standard range.

H. Soffit Panels: Same as wall panels.

I. Trim, Closure Pieces, Expansion Joints, and Flashings: Same material , thickness and finish as exterior sheets; factory-fabricated to required profiles; fabricated in longest practicable lengths.
   1. Exposed Fasteners: Not permitted.

2.04 MATERIALS

A. Precoated Galvanized Steel Sheet: ASTM A653/A653M, Commercial Steel (CS) or Forming Steel (FS), with G90/Z275 coating; continuous-coil-coated with acrylic primer coat, polyvinyl fluoride (PVF) top coat, and polyester washcoat for panel back.
   1. Color of Exposed Exterior Surfaces: As selected by Architect from manufacturer's full range.

B. Foamed-in-Place Insulation: Urethane type.

2.05 ACCESSORIES

A. Anchors: Galvanized steel.

B. Fasteners: Manufacturer's standard type to suit application; hot-dip galvanized steel with soft neoprene washers; provide with fastener cap same color as exterior panel.

C. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structural framing is ready to receive panel system.

3.02 INSTALLATION

A. Install panel system on walls in accordance with manufacturer's instructions.

B. Protect panel surfaces in contact with cementitious materials with bituminous paint; allow paint to dry prior to installation.

C. Permanently fasten panel system to structural supports; aligned, level, and plumb, within specified tolerances.

D. Locate panel joints over supports.

E. Use concealed fasteners unless otherwise approved by Architect.

F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch (6 mm).

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove site cuttings from finish surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 4213.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.

B. Matching flashing and trim.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Panel support framing.

B. Section 07 2500 - Weather Barriers: Water-resistive barrier behind wall panel system.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.

D. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

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); 2017a.

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 A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

F. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2017.

G. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

I. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2021).

J. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

L. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

O. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
   1. Require attendance by the installer and relevant sub-contractors.
   2. Include MCM sheet manufacturer's representative and wall system manufacturer's representative to review storage and handling procedures.
   3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
   4. Review procedures for protection of work and other construction.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.

C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
   4. Specimen warranty for wall system, as specified herein.

D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, exposed fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches (1:10).
   6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

E. Verification Samples: For each finish product specified, submit at least three samples, minimum size 12 inch (305 mm) square, and representing actual product in color and texture.

F. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

G. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

H. Test Report: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.

I. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

J. Testing agency's qualification statement.

K. Maintenance Data: Care of finishes and warranty requirements.

1.06 QUALITY ASSURANCE

A. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy-duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well-ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of accumulated water.
   4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).
   5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of wall panels. Complete forms in St. Cloud School District 742's name and register with warrantor.

C. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in St. Cloud School District 742's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet Manufacturers:
   1. 3A Composites USA: www.3Acompositesusa.com.
   2. Laminators Inc: www.laminatorsinc.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.

1. Basis of Design: 3A Composites Alucobond Dry Reveal.
    a. (MTL PNL-60): Exterior; Color: as selected by Architect.
    b. (MTL PNL-61): Interior; Color: as selected by Architect.
2. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
3. Anchor panels to supporting framing without exposed fasteners.

2.03 PERFORMANCE REQUIREMENTS

A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F (minus 29 degrees C) to 180 degrees F (82 degrees C) without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

B. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
1. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
2. Maximum anchor deflection in any direction of 1/16 inch (1.6 mm) at connection points of framing members to anchors.

C. Air Leakage: 0.10 cfm/sq ft (0.50 L/sec sq m) maximum leakage when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E283/E283M.

D. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.27 psf (300 Pa) minimum, after 15 minutes.
1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
2. Design to drain leakage and condensation to the exterior face of the wall.

E. Fire Performance: Use test method complying with NFPA 285.

2.04 PANELS

A. Panels: 2-1/2-inch (63.5 mm) deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
1. Reinforce corners with riveted aluminum angles.
2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
5. Metallic Finished Panels: Maintain consistent grain of MCM sheet; specifically, do not rotate sheet purely to avoid waste.
6. Fabricate panels under controlled shop conditions.
7. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
8. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.

a. Make panel lines, breaks, curves, and angles sharp and true.
b. Keep plane surfaces free from warp or buckle.
c. Keep panel surfaces free of scratches or marks caused during fabrication.

9. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.

2.05 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
   1. Overall Sheet Thickness: 0.157 inch (4 mm), minimum.
   2. Face Sheet Thickness: 0.019 inch (0.50 mm), minimum.
   3. Alloy: Manufacturer's standard, selected for best appearance and finish durability.
   4. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch (100 N-mm/mm) with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).
   5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   6. Flammability: Self-ignition temperature of 650 degrees F (343 degrees C) or greater when tested in accordance with ASTM D1929.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
   1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.

2.06 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturer’s standard line.

B. Color/Texture: As selected by Architect from manufacturer's full range.

2.07 ACCESSORIES

A. Flashing: Sheet aluminum; 0.040 inch (1.0 mm) thick, minimum; finish and color to match MCM sheet; see Section 07 6200 for additional requirements.

B. Anchors, Clips, and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666/A666M.
   2. Steel complying with ASTM A36/A36M and hot-dip zinc coating to ASTM A153/A153M.
   3. Steel complying with ASTM A36/A36M and hot-dip galvanized to ASTM A123/A123M, with Coating Thickness Grade of 100.

C. Fasteners:
   1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
   2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
   3. Bolts: Stainless steel.

4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

D. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 15-mil (0.38 mm) dry film thickness per coat.

E. Joint Sealer: Provide color to match wall panels silicone sealant of type approved by MCM sheet manufacturer, and in compliance with ASTM C920.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.

B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

H. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:

1. Variation From Plane or Location: 1/2 inch in 30 feet (10 mm in 10 m) of length and up to 3/4 inch in 300 feet (20 mm in 100 m), maximum.
2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch (0.75 mm), maximum.

I. Replace damaged products.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

3.05 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.06 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

SECTION 07 4243 - COMPOSITE WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Composite wall panel system and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 2600 - Vapor Retarders.

B. Section 07 2700 - Air Barriers.

C. Section 07 6200 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2022, with Editorial Revision (2023).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each product.

C. Shop Drawings: Indicate layout, panel locations, and configuration.

1. Indicate size, spacing, and location of support and attachment components, connections, and types and locations of fasteners.
2. Indicate necessary provisions for structural and thermal movement between wall panel system and adjacent materials.

D. Samples: Submit two samples of each style and color panel, 12 by 12 inches (305 by 305 mm) in size and showing finish color, sheen, and texture.

E. Manufacturer's Instructions: Include instructions for storage, handling, preparation, and product installation.

F. Executed installation warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.

C. Store products under waterproof cover, well ventilated, and elevated above grade on flat surface.

D. Protect materials from harmful environmental elements, construction dust, direct sunlight, and other potentially detrimental conditions.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Installation Warranty for Building Rainscreen Assembly: Provide 10-year warranty including, but not limited to, defective materials and workmanship, labor, and removal of materials to effect repairs and restore to watertight conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Resin Composite Panels:
   1. Parklex Prodema: www.parklexprodema.com
   2. Substitutions: Section 01 6000 - Product Requirements.

2.02 COMPOSITE WALL PANELS

A. Panels, General: Fiber-cement sheets complying with ASTM C1186, Type A.
   1. Design Wind Loads: Comply with requirements indicated on the drawings.
   2. Maximum Allowable Deflection of Panel: L/240 for length (L) of span.
   3. Surface Burning Characteristics: Maximum flame spread index of 0 and maximum smoke developed index of 5 when tested in accordance with ASTM E84.

B. Textured Panel Style (COMP PNL-20): Simulated flat metal or phenolic panel appearance.
   1. Basis of Design: Parklex NATURCLAD-B Cladding with Concealed Fasteners.
      a. (COMP PNL-20): Exterior.
      b. (COMP PNL-21): Interior.
   2. Color: Anise.

2.03 ACCESSORIES

A. Flashing: Sheet aluminum; see Section 07 6200.

B. Sealant: ASTM C920, Class 35, elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate; clean and repair as required to eliminate conditions detrimental to proper installation.

B. Verify that water-resistive barrier has been properly installed and approved.

C. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install cladding in accordance with manufacturer's installation instructions and approved shop drawings.

B. Wall Panels:
   1. Install in accordance with manufacturer's instructions.
   2. Install wall panels with manufacturer's recommended concealed attachment system.
   3. Do not install wall panels less than 6 inches (150 mm) above surface of ground or closer than 1 inch (25 mm) to surfaces where water may collect.
   4. Allow space for thermal movement at ends of wall panels that butt against trim; seal joint between panel and trim.

C. Install control and expansion joints as detailed on drawings.
   1. Vertical Joints: Install at locations and with spacings recommended by wall panel manufacturer.
   2. Horizontal/Compression Joints: Install at locations and with spacings recommended by wall panel manufacturer.

D. After installation, seal joints. Include joints around penetrations and between wall panels and adjacent construction.

3.03 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris. Leave work clean, unmarked, and free from dents, creases, waves, scratch marks, or other damage to finish.

3.04 PROTECTION

A. Protect installed products until Date of Substantial Completion.

END OF SECTION

SECTION 07 5100 - BUILT-UP BITUMINOUS ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Built-up roofing membrane, conventional and protected membrane application.
B. Insulation, flat and tapered.
C. Vapor retarders.
D. Deck sheathing.
E. Cover boards.

1.02 REFERENCES

A. Materials used in this section shall be listed in the latest editions of the following:
   1. Factory Mutual System Approval Guide - equipment, materials, services for conservation of property.
   2. Underwriters Laboratories, Inc. - building materials directory.
   3. NRCA Roofing and Waterproofing Manual, fifth edition - National Roofing Contractors Association.
B. Roof insulation must meet the requirements of FM 4450 or UL 1256.
C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

1.03 DESCRIPTION

A. Furnish and install a weather and watertight asphalt built-up roof complete, in place, as shown on the drawings and specified herein, for a complete and proper installation including, but not necessarily limited to:
   1. Contractor shall take all necessary precautions to protect Owner's property from damage caused by weather conditions, excessive loading of the existing structural system or careless workmanship.
   2. Metal cap flashings, counterflashings, and miscellaneous sheet metal work incorporated into the work shall be installed and made watertight as a part of the work of this section.
   3. Installation of wood nailers, wood edge strips and plywood backers in accordance with manufacturer's specifications and/or as shown on drawings. Contractor shall coordinate the installation of all carpentry work required for the membrane system herein specified.
B. Work included:
   1. Provide and install all roof and deck insulation and insulation fasteners as shown on the roof plan and detail drawings.

1.04 SUBMITTALS

A. Product Data: Within ten (10) calendar days after award of contract, submit:
   1. Complete material list of all items proposed to be furnished and installed under this section.
   2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
   3. Manufacturer's recommended methods of installation.
   4. When approved by the Architect/Engineer, the manufacturer's recommended methods of installation (unless superseded by the specifications) will become the basis for accepting or rejecting the installation.

B. Certification from the manufacturer that roofing Contractor is currently approved for installation of the specified roofing system.
C. Samples and test results for materials when requested by the Architect/Engineer.
D. Roof system details at roof edges, drains, scuppers, penetrations, terminations, curbs and flashings.
E. Manufacturer Certificates:
    1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
        a. Submit evidence of compliance with performance requirements.
F. Product Test Reports: For roof insulation, tests performed by a qualified testing agency, indicating compliance with specified requirements.
G. Evaluation Reports: For components of roofing system, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Standards: Comply with the standards specified in this section and as listed in the general requirements.
B. Qualifications of manufacturer: Products used in the work included in this section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to the Architect/Engineer.
C. Qualifications of Contractor: The Contractor and contract personnel shall be currently approved by the manufacturer of the approved products as qualified to install the materials of this section.
D. Qualifications of installers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper work in this section.
E. Roofing Inspections: Make all required notifications and secure all required inspections by the manufacturer of the approved materials to facilitate issuance of the specified roof warranty.
F. Provide and install roofing system in accordance with the manufacturer's current recommendations, as required by the referenced standards, meeting Factory Mutual Class I roof system with FM 1-60 wind uplift rating and meeting the requirements of the Contract Documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:
    1. Deliver all packaged materials to the job site in their original, unopened containers with all labels intact and legible, no sooner than five (5) calendar days prior to start of job.
    2. Store all materials in an approved manner, up off of the roof deck or ground on wooden pallets, and protected from exposure to the elements on all sides with tarps extending to the ground. Manufacturers' wraps or covers are not acceptable protection. Note: All insulation materials, felts, and other "waterproof" materials shall be protected as described above.
        a. Contractor is responsible for all materials delivered to job site until completion of project.
        b. When storing materials on the roof, do not over-stress deck.
B. Store all rolls of felt, cartons and drums of asphalt roof cement, primer, and coating on end.
C. Protection:
    1. Use all necessary means to protect the materials in this section before, during and after installation, and to protect the work and materials of all other trades.
D. Replacements:
    1. In the even of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer, at no additional cost to the owner.

E. Work is to be performed on a daily basis, with each section completed before progressing to the next days work.

F. Completion of work shall be defined as the installation of all specified substrate preparation, vapor retarder (if required), insulation and membrane completely sealed at perimeters, curbs and penetrations.

1.07 "R" VALUES

A. Isocyanurate insulation thermal values shall be determined in accordance with ASTM: C 1303.

B. The project shall have a minimum R-value of 30.

1.08

A. Work is to be performed on a daily basis, with each section completed before progressing to the next day's work.

B. Completion of work shall be defined as the installation of all specified roof preparation, insulation roof membrane, and flashings to ensure a waterproof system.

C. Contractor shall complete roofing work on a daily basis unless specifically directed otherwise by the Architect/Engineer.

1.09 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.

1.10 WARRANTY

A. As part of the work of this section, apply all required fees, secure all required inspections, and complete all items necessary to secure and deliver to the Owner a Contractor's two (2) year labor and material warranty and manufacturer's thirty (30) year labor and material (NDL) No Dollar Limit Warranty.

1. Before final payment by Owner, Contractor shall submit system manufacturer's warranties and contractor's warranty directly to Owner.

B. There will be no penal sum per square of roofing.

C. Repairs shall be made promptly.

D. If any moisture infiltration is experienced through the system, the manufacturer is to cover the cost of any repairs to the roof leaks and effected underlying insulation that was part of this project.

E. The manufacturers are to include any repair of any blister formations within the membrane assembly.

F. The manufacturers are to include the repair of any delaminated base flashings.

G. The manufacturers are to include any repair to any damage caused by winds up to 72 miles per hour.

PART 2 PRODUCTS

2.01 GENERAL

A. Minimum product requirements have been listed. All of these components must be used and bid.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
   1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746/C 3746M, ASTM D 4272/D 4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897.
   1. As required by the Minnesota State Building Code for the Wind Design Criteria for this building.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class B; for application and roof slopes indicated; testing by a qualified testing agency.
   1. Identify products with appropriate markings of applicable testing agency.

2.03 FINISHING FELTS

A. Fiberglass roofing felts shall meet or exceed ASTM: D2178, Type VI and supplied by:
   1. Firestone Building Products: www.firestonebpco.com.
   2. Johns Manville: www.jm.com.
   3. GAF Materials Corp: www.gaf.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Organic felt, meeting the Requirements for ASTM: D226 Type I, shall be used exclusively for nightly tie-offs.

2.04 BASE FLASHINGS

A. Granular-surfaced modified bitumen product combining a glass fiber mat, glass fiber web and/or polyester core as manufactured by an approved manufacturer.

2.05 ROOF BITUMENS

A. Type III (steep) roofing asphalt : conform to ASTM; D312 and have a softening point of 185 degrees F minimum, to 205 degrees F maximum; flash point of 500 degrees F minimum.

2.06 GRAVEL, COATINGS AND CEMENTS

A. Natural gravel shall be commercial grade, washed, 1/2 inch to number 4 sieve, or 3/8 inch to 3/4 inch depending on application, and shall comply with ASTM: C 1863. No more than 10 percent of any lot shall be outside these requirements. Gravel shall be dry and free of dust, soil and foreign matter.

B. Asphalt roof cement for vertical surfaces shall be an asbestos-free trowel grade, asphalt-based and conform to ASTM: D 4568 Type I, Class I.

C. Asphaltic primer shall be suitable for use with asphalt for application to concrete and masonry surfaces and conform to ASTM: D41.

2.07 VAPOR BARRIER

A. Mopped two ply vapor barrier (VPR RET-5).

2.08 INSULATION MATERIALS

A. Insulation to be of the type and minimum thickness as listed here or as shown on the detail drawings.

B. Insulation System Identification:

1. (INSUL-50): Constant thickness polyisocyanurate insulation; minimum two staggered layers of equal thickness; provide tapered polyisocyanurate insulation as needed.
2. (INSUL-51): Tapered polyisocyanurate insulation over constant thickness polyisocyanurate insulation; minimum two staggered layers of equal thickness; provide tapered insulation over entire roof as indicated in the drawings.

C. Rigid Cover Board (Top Layer or tapered Built-Up Roof System) (RF BRD-3):

1. Perlite roof insulation is to conform to ASTM: C 728. Insulation is to be supplied in 2 foot x 4 foot boards.
2. Thickness to be as shown on detail drawings.
3. Approved Products:
   a. Fesco Board by Johns Manville: www.jm.com.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.09 RELATED MATERIALS

A. Means of Attachment:

1. Screw-and-Plate:
   a. Corrosion-resistant, self-tapping, self-drilling, self-drilling screw with low profile head. Fasteners to be carbon steel with corrosion resistant coating. Fastener shall show no more than 10 percent red rust corrosion after 30 cycles or Kesternich testing.
   b. Corrosion-resistant, factory-made plate.
   c. Screw-and-plate type fastener to be Factory Mutual approved.
   d. Approved Products:
      1) UltraFast by Johns Manville: www.jm.com.
      2) Roof Grip by ITW Buildex: www.buildex
      3) Insulation Fastener by OMG Roofing Products: www.omgroofing.com.
      4) Dekfast by SFS Intec: sfsintecusa.com.
   e. Fasteners to be of sufficient length to penetrate top flange of deck by 3/4 inch.
2. Roofing Bitumens:
   a. Type III (steep) roofing asphalt shall conform to ASTM D 312 and have a softening point of 185 degrees F minimum, to 205 degrees F maximum flash point of 500 degrees F minimum.

2.10 DECK BOARD

A. Cover Boards (RF BRD-1): Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.

1. Thickness: 5/8 inch (15.9 mm), Type X, fire-resistant.
2. Manufacturers:
   a. USG Corporation; Securock Ultralight Glass-Mat Roof Board: www.usg.com.
   b. DensDeck Prime by Georgia-Pacific.
   c. Substitutions: See Section 01 6000 - Product Requirements.

2.11 ACCESSORIES

A. Lead flashing for roof drains.

1. Material shall weigh 4 lbs. per square foot.
2. Material shall be approximately 1/16 inch in thickness.
3. Material shall meet the requirements of ASTM: B749-97, "Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products."
4. Material Shall be provided in continuous sheets sized to extend 12inch beyond the drain body.

B. Pipe or vent jackets shall be a frost-proof type with a lead cap and fabricated of galvanized iron, and designed for use on flat roof construction. Verify at work site for quantity and size.
   1. Approved Products:
      a. No. 1-F flat plumbing vent flange by F.J. Moore Manufacturing Company: www.fjmooremfg.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Fasteners shall be of adequate design to achieve substantial and positive anchorage.
   1. Nails for flashings and roofing felts shall be stainless steel or zinc-coated type with one inch caps.

D. Two-part pourable sealer for pitch pans shall be supplied by the system manufacturer.

PART 3 EXECUTION

3.01 GENERAL

A. The latest manufacturer specifications and installation techniques are to be followed.

3.02 INSPECTION

A. Examine the areas and conditions under which work in this section will be installed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until such conditions have been corrected.

3.03 SURFACE CONDITIONS

A. Surfaces scheduled to receive roofing and insulation are to be free of any standing water, dew, loose debris, dust and dirt.

B. Substrate is to be smooth, free of sharp projections, and free of obvious depressions.

C. All metal fittings specified or shown on drawings are to be in place before roofing.

D. All nailers shall be securely installed prior to insulation and roofing.

3.04 JOB CONDITIONS

A. Protection:
   1. Existing work shall be properly protected from damage or soiling during the process of removal of existing roofing and installation of new roofing material. Exercise special care at openings through roof and at roof edges. Spill no roofing materials on building surfaces. Any finished work damaged in the execution of work of this section, including lawns/shrubbery, shall be replaced or restored to the original condition by this Contractor.
   2. Contractor shall protect existing roofing that is not scheduled to be removed with minimum 3/4 inch thick plywood protection board. Any damage to existing roof shall be repaired by Contractor.

B. Workmanship:
   1. Roofing work shall be accomplished to fulfill requirements of the drawings and specifications. Any specific directions furnished by the manufacturer regarding the application of their materials shall be strictly followed.
   2. After starting work, Contractor is responsible for complete moisture integrity of the roofing and flashing membrane. Therefore, this Contractor shall:

a. Not apply insulation or membrane under any conditions not suitable.
b. Exercise care to ensure adequate quantities of materials are used.
c. Maintain competent supervisor at the work site, with authority to discard unsuitable materials or remove unsatisfactory workers.
d. Observe all precautions involving the storage and handling of roofing materials.

3.05 HANDLING, HEATING AND APPLICATION TEMPERATURE OF ASPHALT

A. If pumper kettles only are used on the project, then the asphalt shall be delivered to the job site in cartons and/or cans.
B. If tankers are used, the asphalt in the tanker shall not be heated to above 475 degrees F.
C. The heating of asphalt should conform to the equiviscous temperature range concept (EVT).
D. Never heat the asphalt to or above the actual Cleveland Open Cup (COC) flash point, (FPT).
E. The asphalt manufacturer must label each carton of asphalt with the EVT and FPT temperatures.
F. All asphalt delivered to the site shall meet ASTM D312 requirements according to testing conducted by an independent testing laboratory. This is the responsibility of the Contractor and costs of such tests are to be included in bid price.
G. The application or embedment temperatures of asphalt shall be within 25 degrees F. of the equiviscous temperature (EVT) for optimum application.

3.06 INSULATION BOARD ATTACHMENT

A. Rigid insulation to be loosely laid with all joints staggered and tightly butted. Insulation board to be cut to fit tightly around projections.
B. Fasten insulation board with screw-and-plate type fasteners, minimum spacing to be one fastener every two square feet. If manufacturer's fastening requirements exceed those of this section, then manufacturer's recommendations are to be followed.
C. Ensure the fasteners do not penetrate conduit or miscellaneous piping located at bottom of the decking.
D. Insulation board attachment shall meet Factory Mutual research wind storm resistance classification 1-60.

3.07 INSULATION INSTALLATION - CONVENTIONAL APPLICATION

A. Ensure vapor retarder is clean and dry, continuous, and ready for application of roofing system. B.
1. Embed each layer of insulation into flood coat mopping of hot bitumen in accordance with roofing and insulation manufacturers' instructions.
B. Lay subsequent layers of insulation with joints staggered minimum 6 inch 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 apply more insulation than can be covered with membrane in same day.

3.08 VAPOR BARRIER INSTALLATION - CONVENTIONAL APPLICATION

A. Mopped Two-ply Vapor Barrier applied over deck sheathing over metal and concrete decks:
1. Apply primer at a rate of 1 gal/square and allow to dry.
2. Mop surface with hot bitumen and embed two plies of vapor retarder felt; lap plies 19 inches, full mop each ply.
3. Apply bitumen at 20 lb/square.
4. Glaze top surface of the vapor retarder with bitumen if insulation is not placed immediately.

B. Extend vapor barrier under cant strips and blocking.

C. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

3.09 MEMBRANE INSTALLATION

A. Over insulation, apply five plies of roofing felt set in hot (at EVT) asphalt as specified to yield a 7.4 inch exposure using one meter wide felt and 6.8 inches using 36 inches wide felts.

B. Install each felt so that it shall be firmly and uniformly set, without voids, into the hot (within 25 degrees F of EVT). Type II (flat) asphalt applied just before the felt at a nominal uniform rate of 25 lbs/100 sq ft +/- 25 percent.

C. Felts are to be broomed into the hot asphalt with a soft bristle push-broom.

D. Do not walk directly on felts for a minimum of 20 minutes to allow for proper adhesion of the felts. Note: No phased construction is to be allowed. The roof section is to be completed with a full five-ply application at the end of each working day. If it should become necessary to employ a phased application due to a sudden rainstorm, the temporarily installed felts will be removed prior to a full five-ply application. Note: All felts shall be installed so that the head laps will be with the flow of water.

E. Install five plies of fiberglass finishing felts extending to the top of the cant and trimmed level.

3.10 BASE FLASHINGS

A. Install two plies of fiberglass backer felt in solid moppings of Type III (steep) asphalt, extending four and six inches onto the field of the membrane construction and extending up the vertical surface a minimum of eight inches.

B. Apply granular-surfaced modified bitumen base flashings, extending eight inches onto the field of the membrane construction, and extending up the vertical section a minimum of eight inches. All base flashings shall be installed by heat-fusing or solid asphalt (Type III) mopping the material to the substrate and, while pliable, rubbing it in so as to achieve intimate contact. The horizontal seam of the completed base flashing shall them be mechanically fastened using simplex-type nails with one-inch disc heads eight inches on center.

C. Apply a solid troweling of asphalt roof cement to the exposed heads of the mechanical fasteners and along the horizontal edge and, while pliable, embed a four-inch width of fiberglass reinforcing fabric.

D. Install self-adhering membrane or 45 mil EPDM to cover the base flashings, as shown in the detail drawings. Secure with simplex-type nails with 1 inch disc heads.

3.11 FLOOD AND GRAVEL APPLICATION

A. Embed not less than 400 lbs/100 sq ft of clean, river washed aggregate conforming to ASTM D 1863 requirements into Type II asphalt, using not less than 60 lbs/100 sq ft of roof area. Note: Wet or dirty aggregate is not to be used and should be discarded.

B. Care should be taken to ensure that the aggregate is embedded within five to seven seconds of the application of the asphalt flood coat.

C. Surfaces scheduled to receive roofing gravel are to be free of standing water, dew, or lose debris.

3.12 PITCH PANS

A. Install pitch pans with the flanges embedded in asphalt roof cement.

B. Prime top of metal flanges, then install three stripping plies of fiberglass felts, in hot asphalt.

C. Fill the inside of pitch pan with cut-to-fit, rigid fiberboard insulation, and the top two inches with two-part pourable sealer.

3.13 ASPHALT ATTACHMENT

A. Insulation is to be installed in a solid mopping of hot Type III (steep) asphalt within 25 degrees of manufacturer's recommended EVT, staggered 50 percent from proceeding layer and applied at a rate of 25 lbs/100 sq ft minimum.

B. Insulation boards are to be "stepped in" continuously to ensure 100 percent adhesion.

C. Insulation is to be installed with all joints staggered and tightly butted. Insulation is to fit tightly around projections.

D. Any gaps larger than 1/4 inch are to be filled with similar material.

3.14 VERIFICATION

A. Upon completion of the installation in each area, visually inspect and verify that all components are complete and properly installed. Verify that fasteners are properly located and securely anchored.

3.15 CLEAN UP

A. The Contractor shall clear the construction areas and shall provide for the removal from the building site of all his construction debris.

B. All debris shall be removed from the premises promptly and the construction area left clean daily. Keep all drains clear of debris and in proper order at the end of each working day.

C. At the completion of the contract, the Contractor is to remove all excess materials and equipment related to his contract.

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, downspouts, and exterior penetrations.

B. Sealants for joints within sheet metal fabrications.

C. Precast concrete splash pads.

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); 2017a.

B. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products; 2018 (Reapproved 2024).

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).

F. CDA A4050 - Copper in Architecture - Handbook; Current Edition.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

H. ANSI/SPRI/FM 4435/ES-1 - Wind Resistance Resting for Roof Edge Systems

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Provide testing in compliance with ES-1.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. 316 Stainless Steel (SMF-3): ASTM A666, soft temper, 28 gauge, (0.0156 inch) (0.40 mm) thick, smooth No. 4 - Brushed.

2.02 PREFINISHED ALUMINUM SHEETS

A. Description (SMF-2): Factory-applied topcoat systems applied to aluminum flat sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed side and backing coats on unexposed side.

B. Aluminum Sheet Substrates: ASTM B209/B209M, alloy and temper as recommended by manufacturer for application.

C. Superior Performance Organic Coating System: Comply with AAMA 2605 for aluminum preparation, pretreatment, primer and finish coat system; provide thermally cured 70-percent PVDF fluoropolymer systems; tested for weathering for 10 years with 5 delta units color change maximum.

D. Drawing Detail: As indicated on drawings.

E. Base Metal Thickness: 0.032 inch (0.81 mm), minimum.

F. Color: As selected by Architect from manufacturer's standard colors.

2.03 PREPAINTED, METALLIC-COATED STEEL SHEETS

A. Description (SMF-1): Factory-applied coatings applied to metallic-coated steel sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed, top side of sheet; washcoats on bottom, unexposed sheet side.

B. Comply with ASTM A755/A755M.

C. Metallic-Coated Steel Sheet Substrates:

D. Substrate Preparation for Prefinishing: Clean and prepare substrate surfaces in accordance with coating manufacturer's recommendations for substrate type and application.

E. Washcoats or Backercoats: Provide washcoats or backercoats in accordance with organic coating manufacturer's recommendations.

F. Primer Coats: Provide basecoat primers in accordance with coating manufacturer's recommendations for substrate type, topcoat, and application.

G. Superior Performance Organic Coating System: Provide thermally cured 70-percent PVDF or FEVE fluoropolymer systems in accordance with AAMA 2605, tested for weathering for 10 years with 5 delta units maximum of color change.

H. Drawing Detail: As indicated on drawings.

I. Base Metal Thickness: 24 gauge, 0.024 inch (0.61 mm), minimum.

J. Color: As selected by Architect from manufacturer's standard colors.

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.05 GUTTERS AND DOWNSPOUTS

A. Downspouts (DOWNSPOUT-1): Rectangular profile, open face.

B. Accessories: Profiled to suit gutters and downspouts.

1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.

C. Splash Pads (SPLASH-1): Precast concrete type, of size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.

1. Basis of Design: Amcon Splash Blocks: www.tccmaterials.com.

D. Seal metal joints.

2.06 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer Type: Zinc chromate.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; seal flashings into reglets with sealant.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Secure gutters and downspouts in place with concealed fasteners.

END OF SECTION

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof hatches.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

D. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025.

1.03 SUBMITTALS

A. See Section 01 3000 - 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.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 ROOF HATCHES AND VENTS

A. Roof Hatch Manufacturers:

1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
2. Acudor Products Inc: www.acudor.com.
3. Babcock-Davis: www.babcockdavis.com.
4. BILCO Company: www.bilco.com.
5. Nystrom, Inc: www.nystrom.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Hatches and Smoke Vents: Factory-assembled aluminum frame and cover, complete with operating and release hardware.

1. Type:
   a. (RF HATCH-1): Regular Roof Hatch.
   b. (RF HATCH-2): Impact Resistant; to meet ICC-500 impact rating.
      1) Basis of Design: Cyclone Roof Hatch by RPH Products: www.rphproducts.com.

2. Style: Provide flat metal covers unless otherwise indicated.
3. Mounting Substrate: Provide frames and curbs suitable for mounting on metal deck and concrete.
4. Size: As indicated on drawings; single-leaf style unless otherwise indicated.
5. For Ships Ladder Access: Single leaf; 30 by 54 inches (762 by 1372 mm).
6. Capable of supporting 40 psf (1.92 kPa) live load.
7. Insulation: Manufacturer's standard 3 inch (76 mm) rigid glass fiber.
8. Gasket: Neoprene, continuous around cover perimeter.

C. Safety Railing System: Roof hatch safety rail system mounted directly to curb without penetration of roofing system.

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.

SECTION 07 8123 - INTUMESCENT FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Performance characteristics and test results.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Verification Samples: For each thickness, color, sheen, and finish required, submit samples not less than 4 inches (102 mm) square on designated substrate illustrating finished appearance.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials in manufacturer’s original, unopened containers with identification labels and testing agency markings intact and legible.

C. Store products in manufacturer's unopened packaging until ready for installation.

1. Store at temperatures not less than 50 degrees F (10 degrees C) in dry, protected area.
2. Protect from freezing, and do not store in direct sunlight.
3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.

D. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

A. Protect areas of application from windblown dust and rain.

B. Maintain ambient field conditions, such as temperature, humidity, and ventilation, within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.

1. Provide temporary enclosures as required to control ambient conditions.
2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F (10 degrees C) without specific approval from manufacturer.
3. Ensure that relative humidity is between 40 and 60 percent in areas of application.
4. Provide ventilation in enclosed spaces during application and for not less than 72 hours afterward.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Intumescent Thin-Film Fire Protection for Metal:
   1. Albi Manufacturing Division of StanChem Inc: www.albi.com.
   2. Contego International, Inc: www.contegointernational.com.
   3. Basis of Design: Hilti, Inc: www.us.hilti.com.
   4. Isolatek International Corp: www.isolatek.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Fire Resistive Coating System (FR PRF-20): Thin-film intumescent fire protection system for structural steel, gypsum board, wood, oriented strand board (OSB), concrete, and concrete masonry units (CMU).
   1. Surface Burning Characteristics: Class A, flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   2. For Interior Use:
      a. Use only water-based products.
      b. Use only products without fiber content.
      c. VOC Content: Less than 100 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
   3. For Exterior Use:
      a. Use only water-based products.
      b. Use only products without fiber content.

B. Sealers and Primer: As required by tested and listed assemblies, and recommended by fireproofing manufacturer to suit specific substrate conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fire protection; verify that substrates are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Thoroughly clean surfaces to receive fireproofing.

B. Repair substrates to remove surface imperfections that could effect uniformity of texture and thickness of fireproofing system, and remove minor projections and fill voids that could telegraph through finished work.

C. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system, and provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

3.03 APPLICATION

A. Comply with manufacturer's instructions for each particular intumescent fire protection system installation application as indicated.

B. Apply manufacturer's recommended primer to required coating thickness.
C. Apply fireproofing to full thickness over entire area of each substrate to be protected.
D. Apply coats at manufacturer's recommended rate to achieve dry film thickness (DFT) as required for fire resistance ratings designated for each condition.
E. Apply intumescent fire protection by spraying to maximum extent possible, and as necessary complete coverage by roller application or other method acceptable to manufacturer.
F. Achieve uniform finished appearance complying with approved samples.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
B. Immediately after installation of fireproofing in each area, remove overspray and fallout from other surfaces and clean soiled areas.

3.05 PROTECTION

A. Protect installed intumescent fire protection from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Completion.
B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 8400 - 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 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus; 2025b.

E. 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; 2023a, with Editorial Revision (2024).

F. ITS (DIR) - Directory of Listed Products; current edition.

G. FM (AG) - FM Approval Guide; Current Edition.

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 (DIR) - Online Certifications Directory; Current Edition.

K. UL (FRD) - Fire Resistance Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Certificate from authority having jurisdiction indicating approval of materials used.

F. Manufacturer's qualification statement.

G. 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.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:

1. Verification of minimum three years documented experience installing work of this type.

D. Firestop sealants upon curing, shall not re-emulsify, dissolve, leach, breakdown or otherwise be damaged over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic in a building's normal operating life.

E. Firestop sealants selected shall be sufficiently flexible to accommodate motion such as pipe vibration, water-hammer, thermal expansion, and other normal building movement, without damage to the seal.

F. One manufacturer shall supply all firestopping material to the extent possible.

G. All firestop materials shall be installed prior to expiration of shelf life.

1.05 COORDINATION

A. Schedule firestopping after installation of penetrants, but prior to concealing the openings.

B. Firestopping shall precede gypsum board finishing.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:

1. 3M Fire Protection Products: www.3m.com/firestop.
2. A/D Fire Protection Systems Inc: www.adfire.com.
3. Hilti, Inc: www.us.hilti.com.
4. Nelson FireStop Products: www.nelsonfirestop.com.
5. Specified Technologies Inc: www.stifirestop.com.
6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
7. Substitutions: See Section 01 6000 - 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.

C. Fire Ratings: Refer to drawings for required systems and ratings.

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. Movement: Provide systems that have been tested to show movement capability as indicated.
2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

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. Movement: Provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

D. 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.
   1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping (FR STOP): Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or 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 CONDITIONS REQUIRING FIRESTOPPING

A. General: Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such materials designated as insulation, safing, or otherwise.

B. Through-Penetration: Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetration: Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.

D. Construction Joints/Gaps: Firestopping shall be provided at all fire rated walls as indicated on project drawings.
   1. Between the tops of walls and the underside of floors.
   2. In expansion joints at fire rated walls.
   3. In any penetration through fire rated wall, fill gaps and spaces with fire stopping material sufficient to maintain intended wall rating.
   4. Smoke-Stopping: As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.03 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.

3.04 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.05 MARKING AND IDENTIFICATION

A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces;
2. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition; and
3. Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording. "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS" or other wording.

3.06 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.07 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200 - 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 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
F. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015e1.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include 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. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.
B. 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. Allow sufficient time for testing to avoid delaying the work.

4. Deliver sufficient samples to manufacturer for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
3. Hilti, Inc: www.us.hilti.com.
4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
5. Pecora Corporation: www.pecora.com.
6. Sherwin-Williams Company: www.sherwin-williams.com.
7. Sika Corporation: www.usa-sika.com.
8. Specified Technologies Inc: www.stifirestop.com.
9. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
10. W.R. Meadows, Inc: www.wrmeadows.com.
11. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Leveling Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
3. Pecora Corporation: www.pecora.com.
4. Sherwin-Williams Company: www.sherwin-williams.com.
5. Sika Corporation: www.usa-sika.com.
6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
7. W.R. Meadows, Inc: www.wrmeadows.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints:
   a. Do not seal exterior joints unless indicated on drawings as sealed.
   b. Seal open joints except open joints indicated on drawings as not sealed.
2. Interior Joints:
   a. Do not seal interior joints indicated on drawings as not sealed.
   b. Do not seal gaps and openings in gypsum board and suspended ceilings
   c. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
   d. Seal open joints except specific open joints indicated on drawings as not sealed.
3. Do Not Seal:
   a. Intentional weep holes in masonry.
   b. Joints indicated to be covered with expansion joint cover assemblies.
   c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
   d. Joints where sealant installation is specified in other sections.
   e. Joints between suspended ceilings and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
   1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
   1. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
   2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
   3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
   4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
   5. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
   6. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
D. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.03 JOINT SEALANTS - GENERAL

A. Material ID's:
   1. (SEALANT-1): Joint sealant or caulking with or without backer rod. Type as indicated above.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Cure Type: Multi-component, neutral curing.
   3. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
B. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, non-sagging; not intended for exterior use.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

2.05 SELF-LEVELING JOINT SEALANTS

A. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Multicomponent, 100 percent solids by weight.
   2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
   3. Color: To be selected by Architect from manufacturer's standard colors.
   4. Joint Width, Minimum: 1/8 inch (3 mm).
   5. Joint Width, Maximum: 1/4 inch (6 mm).
   6. Joint Depth: Provide product suitable for joints from 1/8 inch (3 mm) to 2 inches (51 mm) in depth including space for backer rod.
B. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Durometer Hardness, Type A: 80, minimum, after seven days when tested in accordance with ASTM D2240.

2. Color: Warmstone.
3. Basis of Design: Metzger/McGuire; Edge-Pro 80 Semi-Rigid Polyurea Joint Filler: www.metzgermcguire.com.

2.06 ACCESSORIES

A. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 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.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

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.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

SECTION 07 9513 - 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 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Gypsum board control joint trim.

1.03 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); 2013.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

C. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:

1. Construction Specialties, Inc: www.c-sgroup.com.
2. Inpro: www.inprocorp.com.
3. MM Systems Corp: www.mmsystemscorp.com.
4. Nystrom, Inc: www.nystrom.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 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. Basis of Design: Construction Specialties, Inc.
   a. (EXP JT-1): VF Series (Exterior Joints Compressible Foam).
   b. (EXP JT-2): AFW Series (Interior, Flush Mount, Fire Rated).
   c. (EXP JT-3): FWF Series (Interior Joints 1-2 inches).
   d. (EXP JT-4): ASM Series (Interior, Surface Mount).
2. Joint Dimensions and Configurations: As indicated on drawings.
3. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
4. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
5. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.

B. Threaded Fasteners: Aluminum.

C. 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.

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.

3.03 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

END OF SECTION

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Hollow metal frames for wood doors.
C. Fire-rated hollow metal doors and frames.
D. Thermally insulated hollow metal doors with frames.
E. Tornado-resistant hollow metal doors and frames.
F. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.
B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
C. Section 09 9113 - Exterior Painting: Field painting.
D. Section 09 9123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
I. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
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. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
M. ITS (DIR) - Directory of Listed Products; current edition.
N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.
P. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
T. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.
U. UL (DIR) - Online Certifications Directory; Current Edition.
V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
    1. Basis of Design: Steelcraft, an Allegion brand: www.steelcraft.com.
    2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
        a. Ceco Door or Curries, an Assa Abloy Group company: www.cecodoor.com.
        b. Republic Doors, an Allegion brand: www.republicdoor.com.
        c. Substitutions: See Section 01 6000 - 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.
    3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
    4. Door Edge Profile: Manufacturers standard for application indicated.
    5. Typical Door Face Sheets: Flush.

6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
    a. Provide minimum 3/16" plate steel as reinforcement for hardware. If the manufacturer's standard is for a greater thickness at specific locations, provide the thicker of the two standards.
8. Electrified Hardware Preparation:
    a. Provide electrical conduit and junction-boxes as required for electric power and signal routing and for electrical terminations as required to support electrical and electronic hardware indicated in Section 08 7100.
    b. Secure conduit and boxes to the frame and doors. Extend conduit attached to frames 12 inches above frame for connection to conduit furnished by other sections.
    c. Coordinate locations of conduit and boxes with Section 08 7100.
9. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

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. Basis of Design: Steelcraft Series L18.
2. 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 2 - Seamless.
    d. Door Face Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
4. Door Finish: Factory primed and field finished.
5. Maximum U-Factor: 0.370.

B. Interior Doors, Non-Fire Rated:
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 2 - Seamless.
    d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.

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.

C. Fire-Rated Doors:
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 2 - Seamless.
d. Door Face Metal Thickness: 16 gauge, 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").
a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
b. Attach fire rating label to each fire rated unit.
3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

D. Tornado-Resistant Doors (Impact Protected):
1. Design and size door and frame components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M.
a. Design Wind Loads: Comply with requirements of authorities having jurisdiction.
b. Wind-Borne Debris Resistance: Door and frame components shall have UL (DIR) approval for Large and Small Missile impact and pressure cycling at design wind loads.
2. Tornado Shelter Application: Comply with ICC 500 standard.
3. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 4 - Maximum-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
4. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
5. 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: Thermally insulated. Full profile/continuously welded type.
1.
2. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
3. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
4. Weatherstripping: Separate, see Section 08 7100.
5. U-Factor: 0.370 maximum.

D. Interior Door Frames, Non-Fire Rated: Face welded type.

1. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum; except 14 gage, 0.067 inch (1.7 mm) for masonry applications.

E. Door Frames, Fire-Rated: Face welded type.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum; except 14 gage, 0.067 inch (1.7 mm) for masonry applications.

F. Tornado-Resistant Door Frames: With same tornado resistance as door; face welded or full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation.
   1. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.

G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

I. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

J. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 8000.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Silencers: Resilient rubber, fitted into drilled hole; 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 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 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. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 08 7100.

F. Comply with glazing installation requirements of Section 08 8000.

G. Coordinate installation of electrical connections to electrical hardware items.

3.04 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.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.
B. Section 08 7100 - Door Hardware.
C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.
D. Samples: Submit two samples of door veneer, 6 x 6 inch (152 x 152 mm) in size illustrating wood grain, stain color, and sheen.
E. Manufacturer's Installation Instructions: Indicate special installation instructions.
F. Warranty, executed in St. Cloud School District 742'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.

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 7800 - Closeout Submittals for additional warranty requirements.
B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in St. Cloud School District 742's name and register with manufacturer.
    1. 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. Basis of Design: VT Inddustries, Inc: www.vtindustries.com.
2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
    a. Oregon Door; Architectural Series: www.oregondoor.com.
    b. Forte Opening Solutions; Aspiro Select Wood Veneer Doors: www.forteopenings.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. Doors: See drawings for locations and additional requirements.
    1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), 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.
    3. Wood veneer facing with factory transparent finish.

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.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White Maple, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
    1. Vertical Edges: 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. Provide sustainably harvested wood, sourced or labeled as specified in Section 01 6000.
C. Provide composite wood containing no added formaldehyde. See Section 01 6116.
D. Cores Constructed with stiles and rails:
    1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
    2. Provide solid blocking for other throughbolted hardware.
E. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
F. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
G. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
H. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 9 UV Curable Acrylated Epoxy Polyester or Urethane.
      b. Stain: Wheat by VT Industries.
      c. Sheen: Satin.

B. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Glazing: See Section 08 8000.

B. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.

C. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 1613 - FIBERGLASS DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass doors.

B. Fiberglass door frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

1.03 REFERENCE STANDARDS

A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.

C. Shop Drawings: Indicate layout and profiles; include assembly methods.

1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
2. Indicate wall conditions, door and frame elevations, sections, materials, gauges, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.

D. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

E. Maintenance Data: Include instructions for repair of minor scratches and damage.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum 5 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.

1. Store at temperature and humidity conditions recommended by manufacturer.

2. Do not use non-vented plastic or canvas shelters.
3. Immediately remove wet wrappers.

C. Store in position recommended by manufacturer, elevated minimum 4 inches (100 mm) above grade, with minimum 1/4 inch (6 mm) space between doors.

1.08 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty covering materials and workmanship, including degradation or failure due to chemical contact. Complete forms in St. Cloud School District 742's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Laminated Fiberglass Doors:
1. Special-Lite, Inc; AF-100 Smooth Pultruded Fiberglass Door with AF-150 Fiberglass Frame System: www.special-lite.com.
2. Corrim Company: www.corrim.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.
1. Physical Endurance: Swinging door cycle test to ANSI/SDI A250.4, Level A (1,000,000 cycles) minimum; tested with hardware and fasteners intended for use on project.
2. Screw-Holding Capacity: Tested to 890 pounds (404 kg), minimum.
3. Surface Burning Characteristics: Flame spread index (FSI) of 0 to 25, Class A, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
4. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
5. Chemical Resistance: Resist degradation due to exposure to tap water and distilled water.
   a. Chlorine-treated moisture in air.
6. Clearance Between Door and Frame: 1/8 inch (3 mm), maximum.
7. Clearance Between Bottom of Door and Finished Floor: 3/4 inch (19 mm), maximum; not less than 1/4 inch (6 mm) clearance to threshold.
8. Provide frame anchors that allow for variation in rough opening size; allow doors and frames to be field cut up to 2 inch (50 mm) maximum to adjust for field conditions.

2.03 COMPONENTS

A. Doors: Fiberglass construction with reinforced core.
1. Type: As indicated on drawings.
2. Thickness: 1-3/4 inch (44 mm), nominal.
3. Core Material: Manufacturer's standard core material for application indicated.
4. Construction:
   a. Pultruded as single monolithic fiberglass reinforced plastic (FRP) panel.

5. Face Sheet Texture: Smooth.
6. Door Panel Configuration: As indicated on drawings.
7. Subframe and Reinforcements: Manufacturer's standard materials.
8. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.
9. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.

2.04 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

2.05 FINISHES

A. Painted: Two-part aliphatic polyurethane, low VOC industrial coating.
   1. Thickness: Minimum 5 mils, 0.005 inch (0.127 mm) wet thickness.
   2. Color: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.
B. Do not begin installation until substrates have been properly prepared.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
B. Clean and prepare substrate in accordance with manufacturer's directions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.
B. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.
C. In masonry walls, install frames prior to laying masonry; anchor frames into masonry mortar joints; fill jambs with grout as walls are laid up.
D. In stud walls, install frames prior to building walls; anchor frames to studs using concealed anchors.
E. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.
F. Repair or replace damaged installed products.

3.04 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.
B. Adjust hardware for smooth and quiet operation.
C. Adjust doors to fit snugly and close without sticking or binding.

3.05 CLEANING

A. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 1700 - INTEGRATED DOOR OPENING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled and factory-finished hollow metal doors and frames, including hardware for door opening assemblies.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Door hardware submittal requirements.

B. Section 08 7100 - Door Hardware: Additional hardware to be installed on these doors.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

C. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

D. BHMA A156.32 - American National Standard for Integrated Swinging Door Opening Assemblies; 2023.

E. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

C. Shop Drawings: Indicate details of each opening showing elevations, glazing, frame profiles, hardware, and different finish locations, if any.

D. Door Hardware Schedule: Provided at end of section and containing detailed list of each hardware item to be provided on each integrated door opening; coordinate hardware furnished by others.

1. See Section 08 7100 for additional submittal requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver units preassembled and prefinished, with door hardware mounted and functioning, and packaged to protect contents from damage.

B. Store in a clean, dry, and ventilated space having controlled temperature and relative humidity between 30 and 60 percent and in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Integrated Door Opening Assemblies Manufacturers:

1. Basis of Design: Sytegra, XT Series: www.syntegrausa.com.
2. Adams Rite - The Rite Door, an Assa Abloy Group company: www.ritedoor.com
3. Total Door Systems: www.totaldoor.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ASSEMBLIES

A. Door, Frame, and Hardware Assemblies: Provide fully functional, factory-assembled and factory-finished door opening units, complete with door, frame, and hardware; complying with BHMA A156.32 and specified requirements.
   1. Accessibility: Comply with ICC A117.1 and ADA Standards.
   2. Provide additional hardware; see Section 08 7100.

B. Applications:
   1. Door opening assemblies include cross corridor as indicated on drawings.

2.03 PERFORMANCE REQUIREMENTS

A. Comply with requirements of local building code and authorities having jurisdiction, and the following:
   1. Force to Open Interior Swinging Egress Doors, Non-Fire Doors: Not more than 5 lb (22.2 N).
   2. Force to Release Latch for Other Swinging Doors: Not more than 15 lb (67 N) to release latch, not more than 30 lb (133 N) to set door in motion, and not more than 15 lb (66.6 N) to swing door to full open position.

2.04 COMPONENTS

A. Hollow Metal Doors: Doors complying with ANSI/SDI A250.8 construction requirements exceeding Level 3 and Physical Performance Level A, Model 1 - Full Flush; electrogalvanized prior to finishing; manufacturer's standard core and reinforcements.
   1. Door Thickness: 1-3/4 inches (44 mm).
   2. Level 3 Fire-Rated Doors: 16-gauge, 0.053-inch (1.3 mm) thick faces and edges.

B. Hollow Metal Door Frames: Formed steel cased opening complying with ANSI/SDI A250.8 construction requirements exceeding Level 3 and Physical Performance Level A; electrogalvanized prior to finishing.
   1. Type: Full profile welded, 16 gauge, 0.053 inch (1.3 mm), primed for field finishing.
   2. Provide frame anchors for secure installation and to comply with opening performance requirements.

2.05 DOOR HARDWARE

A. See Section 08 7100 for door hardware requirements.

2.06 FINISHES

A. Doors and Frames:
   1. Primed Frames: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
   2. Primed Doors: Where indicated on the door schedule as painted, rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
   3. Doors: Where indicated on the door schedule as prefinished, provide Surfacequest Architectural Fusions to match WDP-#. Pushbar to match door finish. www.surfacequest.com.

2.07 ACCESSORIES

A. Frame Spreader Bar: Provide for preassembled welded frames, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this Work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's requirements and the specified performance requirements.

B. Coordinate frame anchor placement with wall construction.

3.03 TOLERANCES

A. Clearances Between Door and Frame: As specified in ANSI/SDI A250.8.

B. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 3100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Field paint finish.

1.03 SUBMITTALS

A. See Section 01 3000 - 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. Manufacturer's Installation Instructions: Indicate installation requirements.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall and Ceiling Mounted Units:
   1. Panel Material: Steel.
   2. Size: 24 inch by 24 inch (609 mm by 609 mm).
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
      a. Basis of Design: DW-5040 Acudor Flush Drywall Access Door.
   5. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
      a. Basis of Design: BP-2002 Acudor Universal Flush Access Door with Hidden Flange.

B. Wall-Mounted Units in Wet Areas:
   1. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
   2. Size: 24 inch by 24 inch (609 mm by 609 mm).
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
      a. Basis of Design: DW-5040 Acudor Flush Drywall Access Door.
   5. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
      a. Basis of Design: BP-2002 Acudor Universal Flush Access Door with Hidden Flange.

C. Fire-Rated Wall-Mounted Units:
   1. Wall Fire-Rating: As indicated on drawings.
   2. Panel Material: Steel.
   3. Size: 24 inch by 24 inch (609 mm by 609 mm).
   4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

a. Basis of Design: FB-5060 DW Acudor Fire-Rated Access Door.

5. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
    a. Basis of Design: FB-5060 Acudor Fire-Rated Uninsulated Access Door.

2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:
1. ACUDOR Products Inc: www.acudor.com.
2. Babcock-Davis: www.babcockdavis.com.
3. Cendrex, Inc: www.cendrex.com.
4. Karp Associates, Inc: www.karpinc.com.
5. Nystrom, Inc; HVAC - Access Doors: www.nystrom.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Door and Frameless Units (ACC PNL-1): Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
1. Style: Exposed frame with door surface flush with frame surface.
2. Frames: 16-gauge, 0.0598-inch (1.52 mm) minimum thickness.
3. Single Steel Sheet Door Panels: 16-gauge, 0,0625-inch (1.6 mm) minimum thickness.
4. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
5. Steel Finish: Primed.
6. Size: As scheduled above unless otherwise indicated in the drawings.
7. Hardware:
    a. Hardware for Fire-Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
    c. Latch/Lock: Screw driver slot for quarter turn cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 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.

END OF SECTION

SECTION 08 3313 - COILING COUNTER DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated coiling counter doors and operating hardware.

B. Electric motor operation; wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Rough openings.

1.03 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. NEMA MG 00001 - Motors and Generators; 2024.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish.

C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.

D. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.

E. Project Record Documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coiling Counter Doors:

1. Overhead Door Corp: www.overheaddoor.com.
2. The Cookson Company: www.cooksondoor.com.
3. Cornell Iron Works, Inc: www.cornelliron.com.
4. Alpine Overhead Doors, Inc.: www.alpinedoors.com.
5. Raynor Garage Doors: www.raynor.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING COUNTER DOORS

A. Coiling Counter Doors, Non-Fire-Rated: Stainless steel slat curtain.

1. Nominal Slat Size: 1-1/4 inches (32 mm) wide.
2. Finish, Stainless Steel: No. 4 - Brushed.
3. Hood Enclosure: Manufacturer's standard; primed steel.
4. Electric operation.
5. Coiling Door Type 4 - Basis of Design: 651 Series by Overhead Door Corp.

2.03 COMPONENTS

A. Metal Curtain Construction: Interlocking, single-thickness 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: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Stainless Steel Slats: ASTM A666/A666M, Type 304; minimum thickness 20 gauge, 0.04 inch (0.95 mm).

B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.

C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.

D. Lock Hardware:
   1. For motor operated units, additional lock or latching mechanisms are not required.

E. Roller Shaft Counterbalance: Steel pipe and torsion 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: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction (AHJ) as suitable for purpose specified and indicated.
   1. Provide interlock switches on motor operated units.

B. Electric Operators:
   1. Basis of Design: RMX by Overhead Door Corp.
   2. Mounting: Above shaft mounting.
   3. Motor Enclosure: NEMA MG 00001.
   4. Motor Rating: As recommended by manufacturer; continuous duty.
   5. Motor Voltage: 110-120 VAC, single phase, 60 Hz.
   6. Opening Speed: 6 inches per second (150 mm/sec).
   7. Manual override in case of power failure.

C. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each electrical operator.
   1. Controls: 24 VAC circuit.
   2. Surface mounted; Location: as indicated on drawings.

D. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that adjacent construction is suitable for door installation.

B. Verify that door opening is plumb, header is level, and dimensions are correct.

C. Notify Architect of any unacceptable conditions or varying dimensions.

D. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Division 26.

F. Complete wiring from disconnect to unit components.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).

C. Maximum Variation From Level: 1/16 inch (1.5 mm).

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3323 - OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric operators and control stations.

B. Wiring from electric circuit disconnect to operators and control stations.

1.02 REFERENCE STANDARDS

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

B. ITS (DIR) - Directory of Listed Products; current edition.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

E. NEMA MG 00001 - Motors and Generators; 2024.

F. UL (DIR) - Online Certifications Directory; Current Edition.

G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - 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.

D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Metal Doors:

1. Alpine Overhead Doors, Inc.: www.alpinedoors.com.
2. Clopay Building Products: www.clopaydoor.com.
3. Cornell Iron Works, Inc.: www.cornelliron.com.
4. McKeon Door Co: www.mcckeondoor.com.
5. Overhead Door Corporation: www.overheaddoor.com.
6. Raynor Garage Doors: www.raynor.com.
7. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING DOORS

A. Overhead Coiling Door Type 1:
   1. Basis of Design: Allura Shutter 653 by Overhead Door Company.
   2. Finish: Prefinished Powder Coat, Silver to match clear anodized aluminum.
   3. Slats: Perforated.
   4. Electrically operated.
   5. Face of wall mounting.

B. Overhead Coiling Door Type 2:
   1. Basis of Design: Safespace S500F by McKeon Door Co.
   2. Finish: Prefinished Powder Coat, Sterling Gray.
   3. Impact and fire rated.
   4. Electrically operated.
   5. Face of wall mounting.

C. Overhead Coiling Door Type 3:
   1. Basis of Design: Cornell Rolling Fire Door Model ERD10.
   2. Finish: Prefinished powder coat; Standard White.
   3. Fire rated.
   4. Electrically operated. Key switch to integrate into building access control system.
   5. Mounting: Jamb mounting.

2.03 MATERIALS

A. Metal Curtain Construction: Interlocking slats.
   1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.

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.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
   1. Minimum thickness; 24 gauge, 24 inch (0.61 mm).
   2. Prime painted.

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:
      a. Interior Coiling Doors: NEMA MG 00001, Type 1; open drip proof.
   3. Motor Rating: 1/2 HP (375 W); continuous duty.
   4. Motor Voltage: 120 volts, single phase, 60 Hz.
   5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   6. Controller Enclosure: NEMA EN 10250, 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 0583 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. See plan for locations and quantity required per door.
   3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
      a. Primary Device: Provide wireless sensing 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 adjacent construction is suitable for door installation.
B. Verify that electrical services have been installed and are accessible.
C. Verify that door opening is plumb, header is level, and dimensions are correct.
D. Notify Architect of any unacceptable conditions or varying dimensions.
E. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.
B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
E. Complete wiring from disconnect to unit components.
F. Install enclosure and perimeter trim.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.
B. Maximum Variation From Plumb: 1/16 inch (1.6 mm).
C. Maximum Variation From Level: 1/16 inch (1.6 mm).
D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet (3.2 mm per 3 m) straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.
B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3513.23 - ACCORDION FOLDING FIRE DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal sliding, accordion folding fire rated doors.

B. Associated construction assembly.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Fire-rated gypsum board.

B. Section 09 9123 - Interior Painting: Finish painting.

C. Section 28 4600 - Fire Detection and Alarm: Connections for activating automatic closing operation.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.

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

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

D. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

E. UL (DIR) - Online Certifications Directory; Current Edition.

F. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's technical literature; include UL listing data.

C. Shop Drawings: Indicate construction and installation details and dimensions, including layout, electrical requirements, required stacking depth, height of header above finished floor; and requirements for anchorage and support of each door.

D. Operation and Maintenance Data: Operating procedures, troubleshooting and repair methods, wiring diagrams, parts lists, and identification of authorized maintenance firms located in vicinity of project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packaging, labeled to show name, brand, and type.

B. Store products in a protected dry location, in manufacturer's original packaging, in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Accordion Folding Fire Doors:

1. Won-Door Corporation; Fire Guard: www.wondoor.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SYSTEM DESCRIPTION

A. Provide motor operated accordion folding fire doors with configurations as indicated on drawings.

B. Fire Door Fire-Rating: 90 minutes.

C. Provide products listed and labeled by UL (DIR) as horizontal sliding accordion folding fire doors at corridor walls or smoke barrier wall locations and other fire partitions with fire-rating indicated, and in compliance with ASTM E119, NFPA 252 or UL 10B fire tests and requirements of authorities having jurisdiction (AHJ).

D. Closing Operation: Automatic motor-operated closing upon activation by low battery charge and fire alarm system. See Division 28.
   1. Obstruction Detection: Contact with an obstruction causes door to stop and pause before attempting to re-close.
   2. Allow manual closing of door at any time.
   3. Interconnect door operation with the access control system for "lock down" operation.

E. Opening Operation: Provide exit hardware on both sides of door.
   1. When door has been closed manually, operation of exit hardware to allow door to open 32 inches (0.81 m), minimum.
   2. When door has been closed automatically, operation of exit hardware to allow door to open at least 32 inches (813 mm), width of opening programmable up to full opening, pause for three seconds and then automatically close.
   3. Access Control: Provide interlocking exit hardware with activation system so that door may not be opened if alarm condition persists; provide key switch to deactivate.

F. Configuration: Bi-parting; straight; recessed in pocket.
   1. Striker Mounting: Recessed.

2.03 COMPONENTS

A. Door Construction: Two parallel, accordion-type walls of independently suspended panels, 6 to 8 inches (152 to 203 mm) apart, without pantographs or interconnections except at lead post.
   1. Panels: V-grooved steel, 24 gauge, 0.0239 inch (0.61 mm); connected by full height steel hinges, 24 gauge, 0.0239 inch (0.61 mm) thick.
   2. Insulation: Manufacturer's standard.
   3. Lead Posts: Cold rolled steel, 24 gauge, 0.0239 inch (0.61 mm); internally mounted stabilizer bar; spring-loaded cap with PVC seals at top and bottom to fit into striker wall cavity; positive latching at striker wall.
   4. Smoke and Draft Seals: Continuous PVC sweeps attached at top and bottom.
   5. Hanging Weight: 6.5 pounds per sq ft (32 kg per sq m), maximum.
   6. Finish: Steel parts, factory-applied enamel.
   7. Color: As selected by Architect, field painted as specified in Section 09 9123.

B. Suspension System: Two tracks, on 8 inch (203 mm) centers, attached to overhead structural support.
   1. Tracks: 14 gauge, 0.0747 inch (1.90 mm) cold rolled steel.
   2. Panel Hangers: Each panel individually suspended from steel hanger pin and 1/4 inch (6 mm) diameter ball bearing roller.
   3. Lead Post Hangers: Eight wheel ball bearing trolley.

C. Motor Operator Assembly: Chain drive attached to stabilizer bar trolley with DC gear-motor, drive sprocket and clutch.

D. Power Supply: 12-volt maintenance-free DC battery, automatically maintained at capacity by continuous charger, 120 VAC.

E. Controls: Microprocessor logic board, interconnect board, motor control relays, and limit switches; provide loud audible signal if sensors indicate high or low voltage, AC or DC; drive train, limit switch, or key switch malfunction; or ROM or RAM check-sum error.

F. Key Switches: Recessed wall-mounted within line-of-sight of door.

2.04 ASSEMBLY

A. Track Support Construction: Provide supports attached to structural system and mounting surface for tracks; comply with accordion door manufacturer's installation instructions and recommendations. Refer to Section 05 1200.

B. Pocket Construction: As indicated on drawings; use Type X gypsum wallboard, unless noted otherwise. See Section 09 2116.

C. Striker Recess: Mount striker in wall recess deep enough to prevent striker from protruding beyond face of wall; construct recess to maintain fire rating of wall.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that adjacent construction is suitable for installation of door.

B. Verify that electrical utilities have been installed and are accessible.

C. Verify access to, and proper clearance for, motor operators in wall cavity.

D. Verify that door opening is plumb and header is level and of correct dimensions.

E. Notify Architect of any unacceptable conditions or varying dimensions.

F. Commencement of work indicates acceptance of substrate and opening.

3.02 INSTALLATION

A. Install accordion folding fire doors in accordance with manufacturer's written instructions, approved shop drawings, and NFPA 80 standards.

B. Install accordion folding fire doors plumb and level.

C. Install wiring in accordance with applicable codes and NFPA 70.

3.03 ADJUSTING

A. Adjust accordion folding fire door installation to provide uniform clearances and smooth, quiet, non-binding operation.

B. Test accordion folding fire doors closing functions under anticipated conditions.

C. Verify that operations are functional and meet requirements of authorities having jurisdiction.

3.04 CLEANING

A. Clean surfaces using manufacturer's recommended means and methods.

3.05 PROTECTION

A. Protect installed work from damage.

B. Repair or replace defective work prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 3613 - SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead sectional doors, electrically operated.
B. Operating hardware and supports.
C. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Steel channel opening frame.
B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
D. 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.
E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
F. DASMA 102 - American National Standard Specifications for Sectional Doors; 2018.
G. ITS (DIR) - Directory of Listed Products; current edition.
H. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
I. NEMA MG 00001 - Motors and Generators; 2024.
J. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. UL (DIR) - Online Certifications Directory; Current Edition.
M. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
C. Product Data: Show component construction, anchorage method, and hardware.
D. Samples: Submit two panel finish samples, 6 x 6 inch (152 x 152 mm) in size, illustrating color and finish.
E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
F. Operation Data: Include normal operation, troubleshooting, and adjusting.

G. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

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

C. Comply with applicable code for motor and motor control requirements.

D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for warranty requirements.

B. Extended Correction Period: Correct defective work within a 2-year period commencing on Date of Substantial Completion.

C. Manufacturer Warranty: Provide 5-year manufacturer warranty for electric operating equipment. Complete forms in Owners name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sectional Doors:

1. Clopay Building Products: www.clopaydoor.com.
2. Midland Garage Door: www.midlandgaragedoor.com.
3. Overhead Door Corporation: www.overheaddoor.com/#sle.
4. Raynor Garage Doors: www.raynor.com.
5. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.

B. Air Leakage Rate: Less than 0.40 cfm/sq ft (2 L/sec/sq m) when tested in accordance with ASTM E283/E283M at test pressure difference of 1.57 psf (75 Pa).

C. Thermal Transmittance: U-factor (Usi-factor) of 0.31 Btu/hr sq ft degrees F (1.76 W/sq m K), maximum, in accordance with DASMA 102.

2.03 ALUMINUM DOORS

A. Doors: Stile and rail aluminum with glazed panels; low headroom operating style with track and hardware; complying with DASMA 102, Commercial application.

1. Basis of Design: Model 521 by Overhead Door Corp.
2. Door Nominal Thickness: 2 inches (50 mm) thick.
3. Finish: Factory anodized; dark bronze.
4. Insulated Panels: 3/8 inch EPS solid panels.
5. Glazed Lites: As indicated on drawings.
    a. Glazing: 1/2 inch insulated glass; SolarBan 70xl; Argon filled.

2.04 COMPONENTS

A. Track: Rolled galvanized steel, 0.090 inch (2.3 mm) minimum thickness; 3 inch (75 mm) wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch (6 mm) thick.

B. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables. Provide high cycle springs; minimum 50,000 cycles.

C. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

E. Head Weatherstripping: EPDM rubber seal, one piece full length.

F. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

G. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

2.05 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Aluminum Sheet: ASTM B209/B209M, 5005 alloy, H14 temper, plain surface.

C. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

D. Float Glass: Provide float glass glazing, unless noted otherwise.

1. Heat-Strengthened and Fully Tempered Types: ASTM C1048.

2.06 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 on cross head shaft.
2. Motor Enclosure:
   a. Exterior Doors: NEMA MG 00001, Type 4; open drip proof.
3. Motor Rating: 1/2 hp (375 W); continuous duty.
4. Motor Voltage: 208 volts, single phase, 60 Hz.
5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
6. Controller Enclosure: NEMA EN 10250, Type 1.
7. Opening Speed: 12 inches per second (300 mm/s).
8. Brake: Adjustable friction clutch type, activated by motor controller.
9. Manual override in case of power failure.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

D. 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 NEMA 1 photo eye sensors as required with momentary-contact control device.

E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

F. Hand Held Transmitter: Digital control, and resettable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

B. Apply primer to wood frame.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

F. Install perimeter trim and closures.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch (1.5 mm).

B. Maximum Variation from Level: 1/16 inch (1.5 mm).

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch (3 mm) from 10 ft (3 m) straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 4313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

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

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

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); 2013.

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).

L. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2017.

M. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - 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. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - 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. 2 inch by 4-1/2 inch, nominal frame profile.
    a. Basis of Design: Kawneer Company, Inc; Trifab VersaGlaze 451T; www.kawneer.com.
    b. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance, including sustainability requirements:
        1) EFCO Corporation; Series 403 Storefront Framing; www.apogeearchmetals.com.
        2) Oldcastle Building Envelope; Series 3000 Thermal MultiPlane; obe.com.
        3) Tubelite Inc; T14000 Series; www.apogeearchmetals.com.
        4) YKK AP America Inc; YES 45 TU; www.ykkap.com.
    c. Finish:
        1) (ALSTOR-1A): Dark bronze anodized.
        2) (ALSTOR-1B): Clear anodized.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING (ALSTOR-2)

A. Center-Set Style, Not Thermally-Broken:

1. 2 inch by 4-1/2 inch, nominal frame profile.
    a. Basis of Design: Kawneer Company, Inc; Trifab VersaGlaze 451; www.kawneer.com.
    b. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
        1) EFCO Corporation; Series 402 Storefront Framing; www.apogeearchmetals.com.
        2) Oldcastle Building Envelope; FG-3000; obe.com.
        3) Tubelite Inc; E14000 Series; www.apogeearch.com.
        4) YKK AP America Inc; YES 45 FI; www.ykkap.com.
    c. Finish:
        1) (ALSTOR-2A): Dark bronze anodized.
        2) (ALSTOR-2B): Clear anodized.

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Not Thermally-Broken:
    1. Basis of Design: Kawneer Company, Inc; 500 Heavy Wall Entrances; www.kawneer.com.
    2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
        a. EFCO Corporation; Series D518 DuraStile; www.apogeearchmetals.com.
        b. Oldcastle Building Envelope; Rugged Entrance Wide Stile Door and Frame; obe.com.
        c. Tubelite Inc; Monumental Doors; www.apogeearchmetals.com.
        d. YKK AP America Inc; 50M Monumental Commercial Entrances; www.ykkap.com.

B. Wide Stile, Insulating Glazing, Thermally-Broken:
    1. Basis of Design: Kawneer Company, Inc; 560 Insulclad Thermal Entrances; www.kawneer.com.
    2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
        a. EFCO Corporation; Series D502 ThermaStile; www.apogeearchmetals.com.
        b. Oldcastle Building Envelope; WS-500TC Thermal Composite Door & Frame Entrances; obe.com.
        c. Tubelite Inc; Therml=Block Entrances; www.apogeearchmetals.com.
        d. YKK AP America Inc; MegaTherm 50T Thermally Broken Entrance Systems; www.ykkap.com.

2.04 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
    1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing.
    2. Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing.
    3. Glazing Position: Centered (front to back).
    4. 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.
    5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
    6. 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.

7. 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.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.

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. Design Wind Loads: Comply with requirements of applicable code.
   b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Wind-Borne-Debris Resistance (ALSTOR-3): Identical full-size glazed assembly without auxiliary protection, tested by independent agency in accordance with ASTM E1996 for Wind Zone ___ - Enhanced Protection for Large and Small Missile impact and pressure cycling at design wind pressure.
3. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 10 psf (480 Pa).
4. 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.
5. Condensation Resistance Factor of Framing: 60, minimum, measured in accordance with AAMA 1503.
6. Overall U-value Including Glazing: 0.34 Btu/(hr sq ft deg F), maximum.

2.05 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.
3. Cross-Section: As indicated on drawings.
4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Glazing: See Section 08 8000.

C. Swing Doors: Glazed aluminum.
1. Top Rail: 5 inches (127 mm) wide, nominal.
2. Vertical Stiles: 5 inches (127 mm) wide, nominal.
3. Bottom Rail: 10 inches (254 mm) wide.
4. Glazing Stops: Square.
5. Finish: Same as storefront.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
C. Fasteners: Stainless steel.
D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.
E. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch (0.48 mm) minimum thickness.
F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
G. Sealant for Setting Thresholds: Non-curing butyl type.
H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
I. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.07 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. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

2.08 HARDWARE

A. For each door, include weatherstripping.
B. Other Door Hardware: See Section 08 7100.

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. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.
H. 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 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for general testing and inspection requirements.

B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 502 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

C. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.06 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.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 4413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.

B. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2025.

C. AAMA 501.4 - Recommended Static Test Method for Evaluating Window Wall, Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drift; 2018.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

G. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

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

I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

J. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

L. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

M. 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.

N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

O. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

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 2 x 4 inches (51 x 102 mm) in size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

G. Energy Performance Certification: For each glazed aluminum curtain wall system and glazing combination provide NFRC CMAST Bid Report. Coordinate with Section 08 8000.

H. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

I. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in St. Cloud School District 742's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of experience.

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in St. Cloud School District 742's name and register with installer.

C. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in St. Cloud School District 742's name and register with warrantor.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN - CURTAIN WALL SYSTEMS

A. Pressure Cap Four Sides; Not Unitized, Field Assembled, 2-1/2 inch (65 mm) wide face plate:
   1. Basis of Design: Kawneer Company, Inc; 1600UT Series Wall System 1.
   2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
      a. EFCO Corporation; XTherm 8250 Unitized Curtain Wall: www.apogeearchmetals.com.
      b. Oldcastle Building Envelope: Reliance TC Type II: www.obe.com.
      c. Tubelite, Inc; 400TU High Performance Thermal Curtainwall: www.apogeearchmetals.com.
      d. YKK AP America, Inc: YCW 750 XT: www.ykkap.com.
   3. Mullions:
      a. (ALCRTN-1): Clear anodized, 8 inches deep with Kawneer mullion extensions.
      b. (ALCRTN-2): Clear anodized, 8 inches deep with standard mullions.
      c. (ALCRTN-3): Clear anodized, 8 inches deep standard mullions, interior.

2.02 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Outside glazed, with pressure plate and mullion cover.
   2. Finish: Class I natural anodized.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   3. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; 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. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
   7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with the requirements of ASCE 7
      a. Member Deflection: For spans less than 13 feet 6 inches (4115 mm), limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch (19 mm), whichever is less and with full recovery of glazing materials.

b. Member Deflection: For spans over 13 feet 6 inches (4115 mm) and less than 40 feet (12.2 m), limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch (1/240 of span plus 6.4 mm), with full recovery of glazing materials.

2. Interstory Differential Lateral Movement: Meeting pass/fail criteria of AAMA 501.4 for Use Group I, Standard Occupancy, when tested at design displacement of 0.010 times greater adjacent story height, maximum, and 1.5 times design displacement, through three complete cycles.

3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
   a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
   b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
   c. Movement of curtain wall relative to perimeter framing.
   d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 psf (480 Pa).
   2. Test Method: ASTM E331.

D. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf (300 Pa) pressure difference across assembly.

E. Thermal Performance Requirements:
   1. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
   2. Overall U-value Including Glazing: 0.34 Btu/(hr sq ft deg F), maximum.

2.03 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. Cross-Section: As indicated on drawings.
   3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Glazing: See Section 08 8000.

C. Infill Panels (CRTN CLPNL-1): Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed, with insulated backpan.
   1. Basis of Design: Americlad Curtainwall Interior Closure Panel.

D. Sill Plate: Provide a subsill plate with integral front lip. Match finish of curtain wall system.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

D. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

E. Exposed Flashings: Aluminum sheet, 20-gauge, 0.032-inch (0.81 mm) minimum thickness; finish to match framing members.

F. Concealed Flashings: Sheet aluminum, 26-gauge, 0.017-inch (0.43 mm) minimum thickness.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: See Section 08 8000.

I. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install curtain 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. Pressure Plate Framing: Install glazing and infill panels using exterior dry glazing method; see Section 08 8000.

H. 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/m) noncumulative or 0.5 inches per 100 feet (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 4000 - Quality Requirements for general testing and inspection requirements.

C. Water-Spray Test: Provide water spray quality test of installed curtain wall components in accordance with AAMA 502 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

D. Window Testing:

1. The newly installed (x) shall be field tested by AAMA accredited independent laboratory, in accordance with **AAMA 503**, "Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems." The area(s) to be tested is (are) as required.
2. Air Leakage resistant tests shall be conducted at a uniform static test pressure of 6.24 psf. The maximum allowable rate of leakage shall not exceed 0.06 cfm/ft^2
3. Water Penetration test shall be conducted at a static test pressure of 12 psf for curtainwall windows.
4. For each test that fails:
    a. Identify reason for the failure.
    b. Repair failure and retest the installation unit until it is completely free of defects.
    c. The Architect/Testing Agent will select two additional windows to be tested. All unsuccessful tests, both original and retest as well as additional windows to be tested due to an unsuccessful test will be paid by the Contractor by deduct change order.
5. The window installer is required to carry an allowance to cover attending the testing and for corrective measure is required.
6. Attendance at the window testing is required for the installing Contractor and General Contractor or Construction Manager.
7. Testing Schedule: As required.

E. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.06 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, take care to remove dirt from corners, and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 08 4435 - PROTECTIVE FRAMED GLAZING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior protective framed glazing assembly.

B. Interior protective framed glazing assembly.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.

B. Section 07 8400 - Firestopping: Firestop at exterior wall assembly junction with structure.

C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.

F. 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.

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

H. ITS (DIR) - Directory of Listed Products; current edition.

I. UL (DIR) - Online Certifications Directory; Current Edition.

J. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide evidence of compliance with fire performance criteria and manufacturer's published product data on framing components, glazing, anchorage and fasteners, and doors, if any.

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 samples as follows illustrating each exposed metal finish of interior and exterior project-specific applications.

E. Test Reports: Submit results of full-size mock-up testing for criteria other than fire performance. Reports of tests previously performed on the same design are acceptable.

F. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in St. Cloud School District 742's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience.

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C), and maintain above this minimum temperature during and for 48 hours after installation.

1.08 WARRANTY

A. See Section 01 7800 - 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 EXTERIOR PROTECTIVE FRAMED GLAZING ASSEMBLIES

A. Single Story Walls (FR STOR-2) with (FR GL-10)

1. SAFTIFIRST, a division of O'Keeffe's Inc; GPX Architectural Series with fire resistive walls/windows: www.safti.com/#sle.

B. Provide factory fabricated, factory finished framing members with glazing and related flashings, anchorage and attachment devices.

1. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" within internal spaces.
2. 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.

C. Fire Performance: Provide hourly fire-resistance-rating as indicated; tested as an assembly including glazing in compliance with ASTM E119 or UL 263 and requirements of local authorities having jurisdiction.

1. Acceptable evidence of compliance includes listing by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction.

D. Structural Performance: Design and size components to withstand the following loading without damage or permanent set.

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 or 3/4 inch (19 mm), whichever is less, under specified design load.
3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
    a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.

b. Expansion and contraction caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period.
c. Movement of wall relative to perimeter framing.
d. Deflection of structural support framing, under permanent and dynamic loads.

E. Water Penetration: No uncontrolled water on indoor face when tested as follows:
1. Test Pressure Differential: 10 pound-force per square foot (480 Pa).

F. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of wall area when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E283/E283M.

2.02 INTERIOR PROTECTIVE FRAMED GLAZING ASSEMBLIES

A. Basis of Design (FR STOR-1) with (FR GL-1):
1. SAFTI FIRST, a division of O'Keeffe's Inc; GPX Architectural Series: www.safti.com.
2. Technical Glass Products; Fireframes Designer Series: www.fireglass.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide factory fabricated, factory finished framing members with glazing and related flashings, anchorage and attachment devices.

C. Fire Performance: Provide hourly fire-resistance-rating as indicated; tested as an assembly including glazing in compliance with ASTM E119 or UL 263 and requirements of local authorities having jurisdiction.
1. Acceptable evidence of compliance includes listing by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction.

2.03 COMPONENTS

A. Framing Members: Formed steel structural members with aluminum cladding and non-combustible thermally-resistive material as required for fire rating.
1. 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 imposed loads.
2. Cross-Section: As indicated on drawings.
3. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.
1. Arrange fasteners and attachments to conceal from view.

C. Exposed Flashings: 20 gauge, 0.032 inch (0.81 mm) thick aluminum sheet; finish to match framing members.

D. Concealed Flashings: 26-gauge, 0.018 inch (0.45 mm) thick galvanized steel.

E. Firestopping: See Section 07 8400.

F. Sealants Within Fire-Rated Assembly: As required by fire-rating and manufacturer's assembly.

G. Sealants: See Section 07 9200 for additional information.

H. Glazing Gaskets: Type to suit application to achieve fire-rating, weather, moisture, and air infiltration requirements.

2.05 FINISHES

A. Finishing: Apply factory finish to surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural metal surfaces are visible in completed assemblies, including joint edges.

B. Aluminum Finish: Class I natural anodized.
   1. Apply factory finish to surfaces that will be exposed in completed assemblies.
   2. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive work of this section; see Section 07 2500 for additional information.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install wall system in accordance with limitations of fire rating and 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. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch every 3 feet (1.6 mm every 0.914 m) non-cumulative or 1/2 inch per 100 ft (12.7 mm per 30.5 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6.4 mm).

3.04 ADJUSTING

A. Adjust doors for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.
B. Glazing units.
C. Plastic films.
D. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 08 4435 - Protective Framed Glazing Assemblies: Glazing fire-tested as part of wall assembly.

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 C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
H. ASTM E413 - Classification for Rating Sound Insulation; 2022.
I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
J. BS EN 14179-1 - Glass in Building - Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass - Part 1: Definition and Description; 2016.
K. GANA (GM) - GANA Glazing Manual; 2022.
L. GANA (SM) - GANA Sealant Manual; 2008.
M. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
O. ITS (DIR) - Directory of Listed Products; current edition.
P. UL (DIR) - Online Certifications Directory; Current Edition.
Q. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Test results from heat soaking.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

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

1.06 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.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:

1. Cardinal Glass Industries: www.cardinalcorp.com.
2. Guardian Glass, LLC: www.guardianglass.com.
3. Oldcastle Building Envelope: obe.com.
4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated. All glazing shall be tempered as required by codes, and as required to meet thermal stress and wind loads.

1. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
4. Heat-Soak Testing (HST): Provide HST of fully tempered glass used on all applications of project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with BS EN 14179-1.

2.03 INSULATING GLASS UNITS

A. Manufacturers:

1. Cardinal Glass Industries: www.cardinalcorp.com.
2. Guardian Glass, LLC: www.guardianglass.com.
3. Oldcastle Building Envelope: obe.com.
4. Pilkington North America Inc: www.pilkington.com.

5. Viracon: www.viracon.com.
6. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. 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. Warm-Edge Spacers: Flexible silicone with polyisobutylene (PIB) primary seal.
a. Spacer Width: As required for specified insulating glass unit.
4. Spacer Color: Black.
5. Edge Seal:
a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
6. Color: Black.
7. Purge interpane space with dry air, hermetically sealed.

C. Insulating Glass Units (INSUL GL-1): Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
a. Tint: Clear.
b. Coating: Low-E (passive type), on #2 surface.
1) Basis of Design:
(a) Guardian Industries: SunGuard SNX 62/27.
(b) Vitro Architectural Glass: Solarban 70.
(c) Viracon: VNE1-63.
4. Inboard Lite: Fully tempered 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)Winter - Center of Glass: 0.24, maximum.
7. Visible Light Transmittance (VLT): 62 percent, minimum.
8. Solar Heat Gain Coefficient (SHGC): 0.26, maximum.
9. Visible Light Reflectance, Outside: 11 percent, minimum.
10. Visible Light Reflectance, Inside: 12 percent, minimum.
11. Glazing Method: Dry glazing method, gasket glazing.

2.04 GLAZING UNITS

A. Monolithic Safety Glazing: Non-fire-rated.
1. Applications: Interior glazing, unless otherwise indicated.
a. Glazed lites in doors, except fire doors.
b. Glazed sidelights to doors, except in fire-rated walls and partitions.
c. Other locations required by applicable federal, state, and local codes and regulations.
d. Other locations indicated on drawings.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.

4. Glass Type: Fully tempered safety glass as specified.
    a. Thickness:
        1) (GL-1): 1/4 inch (6.4 mm), nominal.
5. Tint: Clear.

B. Security Glazing (SEC GL-1): Laminated glass, 2-Ply.
1. Applications: Locations as indicated on drawings.
2. Tint: Clear.
3. Thickness: 1/2 inch (12.7 mm).
4. Outer Lite: Tempered glass.
5. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
6. Inside Lite: Tempered glass.
7. Performance Criteria:
    a. Burglary Resistance: Pass UL 972 tests in compliance with level of burglary and forced-entry resistance indicated; Multiple Impact.
8. Glazing Method: As required to meet performance criteria.

C. (ACST GL-1) Sound Control Glazing: Laminated double insulating glass.
1. Applications: Locations as indicated on drawings.
2. Tint: Clear.
3. Sound Transmission Class (STC) Rating: Provide at least STC 46 rating, conforming to ASTM E90 and ASTM E413.
4. Overall Thickness: As required to meet STC rating as indicated.
5. Laminated Double Insulating Glass:
    a. Outer Layer: Tempered glass.
        1) Thickness: 3/8 inch (9.6 mm).
    b. Air Space: 1 inch (25 mm), filled with air.
    c. Inner Layer, Outboard Side: Annealed glass.
        1) Thickness: 1/4 inch (6.4 mm).
    d. Interlayer: Polyvinyl butyral (PVB), 0.060 inches thick.
    e. Inner Layer, Inboard Side: Tempered glass.
        1) Thickness: 1/4 inch (6.4 mm).
6. Glazing Method: As required to meet STC rating as indicated.

2.05 PLASTIC FILMS

A. Decorative Plastic Film (FILM-1): Polyester type.
1. Basis of Design: See drawings for product information.
2. Application: Locations as indicated on drawings.

2.06 GLAZING COMPOUNDS

A. Manufacturers:
1. Bostik Inc: www.bostik-us.com.
2. Dow Corning Corporation: www.dowcorning.com/construction.
3. Momentive Performance Materials, Inc: www.momentive.com.
4. Pecora Corporation: www.pecora.com.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.07 ACCESSORIES

A. Setting Blocks: Silicone, 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 Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

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 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.

C. Verify that sealing between joints of glass framing members has been completed effectively.

D. 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 within maximum of 24 hours 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. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. 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, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
B. Remove non permanent 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.

3.06 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.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 CONDITIONS

A. Conditions of the contract (General and Supplementary Conditions) and Division 01 - General Requirements, govern the work of this section.

B. This section includes all material and related service necessary to furnish all finish hardware indicated on the drawings or specified herein.

C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.

D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

1.2 WORK INCLUDED

A. This section includes the following:

1. Furnish door hardware specified herein, listed in the hardware schedule, and/or required by the drawings.
2. Cylinders for Aluminum Doors
3. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
4. Electro-Mechanical Devices

B. Where items of hardware are not definitely or correctly specified and are required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

1.3 RELATED WORK IN OTHER SECTIONS

A. This section includes coordination with related work in the following sections:

1. Division 06 Section "Finish Carpentry".
2. Division 08 Section "Hollow Metal Doors and Frames".
3. Division 08 Section "Wood Doors"
4. Division 08 Section “Storm Doors”
5. Division 08 Section "Aluminum Entrances and Storefronts"
6. Division 26 Section “Electrical”
7. Division 28 Section "Electronic Safety and Security".

1.4 REFERENCES

A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.

1. DHI - Recommended Locations for Builders' Hardware.
2. NFPA 80 - Standards for Fire Doors and Windows.
3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
4. UL - Building Material Directory.
5. DHI - Door and Hardware Institute
6. WHI - Warnock Hersey
7. BHMA - Builders Hardware Manufacturers Association
8. ANSI – American National Standards Institute
9. ANSI ICC500 2020 – Standard for the Design and Construction of Storm Shelters
10. IBC- International Building Code (as adopted and amended by local building code)

1.5 SUBMITTALS

A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 01 - General Requirements.

B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:

1. Door number, location, size, handing, and rating.
2. Door and frame material, handing.
3. Degree of swing.
4. Manufacturer
5. Product name and catalog number
6. Function, type and style
7. Size and finish of each item
8. Mounting heights
9. Explanation of abbreviations, symbols, etc.
10. Numerical door index, indicating the hardware set/ group number for each door.

C. When universal-type door closers are to be provided, the schedule shall indicate the application method to be used for installation at each door: (regular arm, parallel arm, or top jamb).

D. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC), or certified Door Hardware Consultant (DHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed or stamped with the DHI certification seal of the supervising AHC or DHC. The supervising AHC or DHC shall attend any meetings related to the project when requested by the architect.

E. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.

F. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or incompatible items, and proposed substitutions in the hardware schedule.

G. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.

H. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 01 - General Requirements.

I. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.

J. Furnish with first submittal, a list of required lead times for all hardware items.

K. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 01 - General Requirements.

L. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.

M. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electro-mechanical devices or systems as required by related trades. Wiring diagrams shall be opening-specific and include both a riser diagram and point to point diagram showing all wiring terminations.

N. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner’s representative to determine keying requirements. Upon completion of initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute’s publication “Keying Procedures, Systems, and Nomenclature”. Submit copies of owner approved key schedule for review and

field use in quantities as required by Division 01 - General Requirements. Wiring diagrams shall be included in final submittals transmitted for distribution of field use.

1.6 QUALITY ASSURANCE

A. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division 01 - General Requirements.

B. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the architect.

C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to ensure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.

E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.

F. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years' experience in successful completion of projects similar in size and scope.

G. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.

H. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.

I. Hardware supplier shall participate when requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy for any unresolved items.

1.7 DELIVERY, STORAGE AND HANDLING

A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.

B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.

C. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receiving material at the job site.

D. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

1.8 PRE-INSTALLATION MEETING

A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.

B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturer's representatives for above hardware items, and any other affected subcontractors or suppliers.

C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.9 WARRANTY

A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division 01 - General Requirements.

B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

PART 2 - PRODUCTS

2.1 FASTENERS

A. All exposed fasteners shall be Phillips head or as otherwise specified and shall match the finish of adjacent hardware. All fasteners exposed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.

B. Coordinate required reinforcements for doors and frames. Seek architect approval prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.2 BUTT HINGES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Stanley	Hager	McKinney
1. Standard Weight, Plain Bearing	5PB1	F179	****	T2714
2. Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714
3. Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
4. Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
5. Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.1 (2006). Hinges shall meet or exceed the following ANSI grade requirements as indicated below:

1. Standard Weight, Plain Bearing Hinges: Grade 3
2. Standard Weight, 2 Ball Bearing Hinges: Grade 2
3. Heavy Weight, 4 Ball Bearing Hinges: Grade 1

C. Unless otherwise specified, furnish the following hinge quantities for each door leaf.

1. 3 hinges for doors up to 90 inches.
2. 1 additional hinge for every 30 inches on doors over 90 inches.
3. 4 hinges for Dutch door applications.

D. Unless otherwise specified, top and bottom hinges shall be located as specified in Division 08 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.

E. Unless otherwise specified, furnish hinge weight and type as follows:

1. Standard-weight plain-bearing hinges or ball-bearing hinges for interior openings up to 36 inches wide without a door closer.
2. Standard weight ball bearing hinges for interior openings 36 to 40 inches wide without a door closer and for interior openings up to 40 inches wide with a door closer.

3. Heavyweight, ball bearing hinges for interior openings over 40 inches wide with a door closer and for all interior vestibule doors.
4. Heavyweight stainless steel ball bearing hinges for all exterior openings unless otherwise listed in groups.
5. Heavyweight 5” height ball bearing hinges for all doors that have an automatic operator.

F. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.

G. Unless otherwise specified, furnish hinges in the following sizes:

1. 5" x 5" 2-1/4" thick doors
2. 4-1/2" x 4-1/2" 1-3/4" thick doors
3. 3-1/2" x 3-1/2" 1-3/8" thick doors

H. Furnish hinges with width to accommodate trim and allow for 180-degree swing.

I. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins. Furnish non-removable pin (NRP) hinges at all reverse-handed doors that are furnished with lockable hardware.

J. Unless otherwise specified, furnish all hinges to template standards.

2.3 CONTINUOUS GEARED HINGES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Hager	Pemko	Stanley
1. Full Mortise	112HD	780-112HD	FMSLFHD	661HD

B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.26, Grade 1 (2012).

C. Continuous hinges shall be geared type hinge providing full height door support up to 600 lbs.

D. Hinge shall be non-handed with symmetrical template hole pattern and factory drilled.

E. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 90 minutes.

F. Provide machine screws for doors which have been reinforced to accept machine screws.

G. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.

2.4 POWER TRANSFERS

A. Acceptable manufacturers and respective catalog numbers:

	Von Duprin	ASSA
1. Concealed Ten Wire	EPT-10	CEPT-10

B. Door cords shall be armored cable with screw on caps.

C. Concealed power transfers shall be concealed in the door and frame when the door is closed.

D. Concealed power transfers shall have a steel tube to protect wires from being cut.

E. Concealed power transfers with spring tubes shall be rejected.

F. Concealed power transfers shall be supplied with a mud box to house all terminations.

2.5 FLUSH BOLTS AND DUST PROOF STRIKES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Trimco	Hager
1. Dust Proof Strike	DP2	3910	280X
2. Auto Flush Bolt (Metal Door)	FB31P	3810	292D

3.	Auto Flush Bolt (Wood Door)	FB41P	3815L	291D
4.	Constant Latching Bolt (Metal Door)	FB51P	3820	293D
5.	Constant Latching Bolt (Wood Door)	FB61P	3825L	294D
6.	Manual Flush Bolt	FB458	3915	282D

B. Unless otherwise specified, provide 12" rods for manual flush bolts for door 7'6" or less, 24" top rods for doors over 7'6" to 8'6".

C. Unless otherwise specified, provide doors over 8'6" with automatic top bolts.

D. Provide automatic flush bolts where required to maintain fire door listing and or egress requirements on pairs of doors.

E. All flush-bolt applications shall be UL listed to be installed with top flush-bolt only. Provide auxiliary fire bolt as required for fire rated openings where less bottom bolt has been specified.

F. Provide all bottom flush bolts with non-locking dust proof strikes.

2.6 EXIT DEVICES

A. Acceptable manufacturers and respective catalog numbers:

		Von Duprin	No Substitution
1.	Wide Stile, Push Pad	99 Series	
2.	Wide Stile, Electric Latch Retraction	QEL 99 Series	
3.	Lever Trim	996 Series	
4.	Pull Trim	990 Series	

A. Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3, Grade 1 (2008).

B. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.

C. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.

D. Quiet Electric Latch Retraction shall be accomplished using a motor driven assembly, and shall incorporate the following features:

1. Motor shall retract both the push pad assembly and latchbolt.
2. Automatic calibration of latch throw and pull.
3. Built-in time delay.
4. On-board installation and troubleshooting diagnostics built into power supply and device.
5. Retry mode if device does not pull on the first try.

E. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.

F. All exit devices shall be provided with flush end caps to reduce potential damage from impact.

G. All exit devices shall be provided with dead-locking latch bolts to ensure security.

H. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.

I. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.

J. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide through bolts as required.

K. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)

L. All exit devices shall be provided with trim designs to match other lever and pull designs used on the project.

M. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.

N. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.

O. Provide Von Duprin #154 or equivalent mullion stabilizers at all doors with removable mullions.

P. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

2.7 EXIT DEVICES (ICC-500)

A. Acceptable manufacturers and respective catalog numbers:

	Von Duprin	No Substitution
1. Wide Stile, Push Pad	WS-T-99 Series	
2. Lever Trim	996 Series	
3. Pull Trim	990 Series	

B. Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3-2008, Grade 1.

C. Exit devices shall be FEMA 361 and ICC500 certified.

D. Exit device shall be tested and approved for compliance and compatibility with manufacturer's tested assembly.

E. Obtain windstorm exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.

F. All exit devices shall be equipped with a sound-dampening feature to reduce push pad return noise.

G. All exit devices shall be provided with flush end caps to reduce potential damage from impact.

H. All exit devices shall be provided with dead-locking latch bolts to ensure security.

I. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.

J. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames.

K. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.

2.8 LOCKS AND LATCHES

A. Acceptable manufacturers and respective catalog numbers:

	Schlage	No Substitution
1. Grade 1 Mortise	L Series 03A	
2. Grade 1 Cylindrical	ND Series TLR	

B. Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2011).

C. Mortise locks shall be independently certified by ANSI for compliance with ANSI A156.13 (2012).

D. Provide full escutcheon at mortise locks with indicators.

E. Unless otherwise specified, all locks and latches have:

1. 2-3/4" Backset
2. 1/2" minimum throw latchbolt
3. 1" throw deadbolt
4. ANSI A115.2 strikes

F. Provide guarded latch bolts for all locksets and latch bolts with throw to maintain fire rating of both single and paired door assemblies.

G. Provide strike with lip length adequate to clear surrounding trim.

H. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

I. Provide temperature control modules for electrified locks to limit transfer of heat to door lever.

2.9 PULLS, PUSH BARS, PUSH/PULL PLATES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Burns	Hager
1. Straight Pull (1" dia., 10" CTC)	8103-0	26C	4J
2. Straight Pull (3/4” dia., 8” CTC)	8102-8	25B	3G
3. Pull / Push-Bar (1" dia., 10" CTC Pull)	9103-0	422 x 26C	153
4. Push Plate (.050 6"X 16")	8200 6" X 16"	56	30S 6 x 16
5. Pull Plate (1" dia., 10" CTC - .050" X 4" X 16")	8303-0 4" X 16"	5426C	34J 4 x 16

A. Adjust dimensions of push plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, push plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled on 4 sides and counter sunk.

B. When mounting straight pull on a wide stile door will prevent access to key cylinder, mount pull offset from cylinder location to allow access to cylinder.

C. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

2.10 COORDINATORS

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Trimco	Hager
1. Bar Coordinator	COR x FL	3094	297D x 297F
2. Mounting Bracket	MB Series	3095/3096	297 Series

B. Provide coordinators at all pairs of doors having automatic flush bolts and closers on the inactive leaf, and for pairs of doors having vertical rod/mortise exit device combinations with overlapping astragals.

C. Provide appropriate filler bars, closer mounting brackets, carry bars, and special top latch preparations as required by adjacent hardware.

2.11 CLOSERS

A. Acceptable manufacturers and respective catalog numbers:

	LCN	No Substitution
1.	4050A / 4050A EDA	

B. Door closers shall be independently certified by ANSI for compliance with ANSI A156.4, Grade 1 (2013).

C. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. Provide extra heavy-duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.

E. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.

F. Closers shall use aluminum cylinders.

G. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.

H. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.

I. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.

J. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.

K. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.

L. Closers shall be furnished with all mounting brackets and cover plates as required by door and frame conditions and by adjacent hardware.

M. Door closers shall be provided with a powder coat finish to provide superior protection against the effects of weathering. Powder coat finish shall successfully pass a 100-hour salt spray test.

2.12 LOW ENERGY ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Acceptable manufacturers and respective catalog numbers:

	LCN	No Substitution
1. Electro-Hydraulic Operator	4640	
2. Wall-mount Actuator, 4-3/4” Square	8310-853	
3. Mullion-mount Actuator	8310-818	
4. Double Vestibule Actuator, 4-3/4” Square	8310-855	

B. Low energy operators shall be independently certified by ANSI for compliance with ANSI A156.19 (2002).

C. Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards.

D. The closing action shall be controlled by modern type cast iron door closer cylinder filled with a flat viscosity fluid, stable from +120F to -30F that would require no seasonal adjustments. The closer shall have field adjustable spring power; have two independent closing speed adjustment valves, and hydraulic back-check.

E. Full closing force shall be provided when the power or assist cycle ends.

F. All power operator systems shall include the following features and functions:

1. Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical Code, section 725-31.
2. The operator will be designed with an electronically controlled mechanical clutching mechanism to prevent damage to the operator if the system is actuated while the door is latched or if the door is forced closed during the opening cycle.
3. All covers, mounting plates and arm systems shall be powder coated and successfully pass a minimum of 100 hours testing as outlined in ANSI/BHMA Standard A156.18.
4. UL listed for use on labeled doors.
5. All operators shall be non-handed with spring power over a range of at least four sizes; either 1 through 4 or 2 through 5.
6. The power operator shall incorporate microprocessor controlled digital controls including factory default memory settings, on-board diagnostics, non-volatile memory, and integrated delay and relay for controlling door release devices.
7. Provisions in the control box or module shall provide control {inputs and outputs) for; electric strike delay, auxiliary contacts, sequential operation, fire alarms systems, actuators, swing side sensors, and stop side sensors.

8. Exterior actuator switches shall be weather resistant and mount on a single gang electrical box furnished by Division 26.

G. All electrically powered operators shall include the following features or functions:
   1. When an obstruction or resistance to the opening swing is encountered, the operator will pause at that point, then attempt to continue opening the door. If the obstruction or resistance remains, the operator will again pause the door.
   2. Easily accessible main power and maintain hold open switches will be provided on the operator.
   3. An electronically controlled clutch to provide adjustable opening force.
   4. A microprocessor to control all motor and clutch functions.
   5. An on-board power supply capable of delivering both 12V and 24V outputs up to a maximum of 1.0 ampere combined load.
   6. All input and output power wiring shall be protected by slow blow fuses. These fuses shall be easily replaceable without special tools or component replacement.
   7. If electrical failure occurs, the unit shall operate as a standard door closer.

H. Power Operators shall be warranted by the manufacturer to be free from defects in material and workmanship for a period of two years.

2.13 PEDESTALS

A. Acceptable manufacturers and respective catalog numbers:

	PedestalPro
1. Steel Gooseneck Pedestal	36-9C 36” BLK
2. Housing	MC-CS-08-E BLK

B. Provide carbon steel pedestal with powder-coat finish.

C. Provide all mounting bolts, plates, and fasteners as required for complete installation.

D. Provide housings, hoods, and mounting boxes as required for all pedestal-mounted equipment.

E. Provide pedestals at locations indicated on Drawings. Verify final pedestal locations with architect.

F. Verify pedestal-mounted equipment mounting heights and locations comply with applicable codes prior to installation.

2.14 KICK PLATES AND MOP PLATES

A. Furnish protective plates as specified in hardware groups.

B. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.

C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled on 4 sides and counter sunk.

D. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing. When protection plates over 16” are provided for labeled doors, the plate shall be labeled.

E. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.

F. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

2.15 OVERHEAD STOPS

A. Acceptable manufacturers and respective catalog numbers:

	Glynn-Johnson	Rixson	Sargent

1. Heavy Duty Surface Mount	GJ900 Series	9 Series	590
2. Heavy Duty Concealed Mount	GJ100 Series	1 Series	690

B. Unless otherwise specified, furnish GJ900 series overhead stop for hollow metal or 1-3/4" solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4" solid core doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.

C. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.

D. Provide special stop only ("SE" suffix) overhead stops when used in conjunction with electronic hold open closers.

E. Do not provide holder function for labeled doors.

2.16 WALL STOPS AND HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Hager	Burns
1. Wrought Convex Wall Stop	WS406CVX	232W	570
2. Wrought Concave Wall Stop	WS406CCV	236W	575
3. Automatic Wall Holder	WS40	326W	533

B. Furnish a stop or holder for all doors.

C. Provide concave style wall stop at all adjacent integral push button locks; provide convex style wall stop at all other locations.

D. Where wall stops are not applicable, furnish overhead stops.

E. Furnish floor stops only where specified in hardware sets.

F. Do not provide holder function for labeled doors.

2.17 MAGNETIC HOLD OPENS

A. Acceptable manufacturers and respective catalog numbers:

	LCN	ABH	Edwards
1. Wall Holder	SEM 7800	2000	1500

B. Magnetic hold opens shall be independently certified by ANSI for compliance with ANSI A156.15, Grade 1 (2006).

C. Magnetic holder housing and armature shall be constructed of die-cast zinc.

D. Where wall conditions do not permit the armature to reach the magnet, provide extensions.

E. Provide proper voltage and power consumption as required by Division 16.

F. Coordinate electrical requirements and mounting locations with related trades.

2.18 WEATHERSTRIP, GASKETING

A. Acceptable manufacturers and respective catalog numbers:

	Zero	Pemko	NGP	Reese
1. Weatherstrip	429	2891_PK	700NA	755
2. Adhesive Gasket	188	S88	5050	797
3. Mullion Seal/Silencer	8780	5110	5100N	628
4. Meeting Edge Seals	8193	18041	9605	959
5. Automatic Door Bottom	369	***	***	***
6. Sweep w/ drip	8198	345_N	C627	354
7. Drip Cap	142	346	16	R201

B. Weatherstrip and gasketing shall be independently certified by ANSI for compliance with ANSI A156.22 (2005).

C. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.

D. Provide weatherstripping all exterior doors and where specified in hardware sets.

E. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.

F. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.

G. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.19 THRESHOLDS

A. Acceptable manufacturers and respective catalog numbers:

	Zero	Pemko	NGP	Reese
1. Saddle Threshold	8655	171	425	S205
2. Thermal Break Saddle Threshold	625	252X3_ FG	8425	S471
3. Half Saddle Threshold	1675	****	325	S245
4. Saddle Threshold (Interior)	63	151	411	S263

A. Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2001).

B. Hardware supplier shall verify finish floor conditions and provide proper threshold as required to provide a smooth transition between finished floor surfaces.

C. Unless otherwise specified or detailed, provide threshold as follows:

1. Provide Zero 8655 or similar saddle threshold for exterior openings with finished floor height transition of ¼" or less.
2. Provide Zero 1675 or similar half-saddle threshold for exterior openings with finished floor height transition of ¼" to ½".
3. Provide Zero 63 or similar low-rise saddle threshold for interior openings when specified with a door sweep or automatic door bottom.

2.20 POWER SUPPLIES

A. Acceptable manufacturers and respective catalog numbers:

	Von Duprin
1. Power Supply	PS900 Series

B. All power supplies shall have the following features:

1. 12/24 VDC Output, field selectable.
2. Class 2 Rated power limited output.
3. Universal 120-240 VAC input.
4. Low voltage DC regulated and filtered.
5. Polarized connector for distribution boards.
6. Fused primary input.
7. AC input and DC output monitoring circuit w/LED indicators.
8. Cover mounted AC Input indication.
9. Tested and certified to meet UL294.
10. NEMA 1 enclosure.
11. Hinged cover w/lock down screws.
12. High voltage protective cover.

C. All power supplies shall incorporate fused distribution boards.

D. All electro-mechanical systems requiring fail safe circuits shall be capable of interfacing with the fire alarm system to cut power to appropriate system components. Unless already provided in

another system component, all power supplies utilized in fail safe circuits shall include an integral relay which when connected to the N/C fire alarm contact will cut power to all openings connected to the individual power supply. Power supply, unless otherwise specified, will automatically reset itself when fire alarm relay returns to normal state following a fire alarm.

2.21 DOOR POSITION SWITCHES

A. Acceptable manufacturers and respective catalog numbers:

	Schlage Electronics	GEI	Sargent
1. Concealed	679 Series	1076W	3287

2.22 SLIDING DOOR HARDWARE

A. Acceptable Manufacturers and respective catalog numbers:

	K.N. Crowder
1. Pocket Door Kit	As specified

B. Provide complete hardware sets for each opening specified with sliding door hardware. Include track, ball-bearing hangers, door stops, fasteners, guides, and all hardware required for a complete installation.

C. Hardware supplier shall coordinate with related trades to ensure that wall pocket framing will accommodate specified hardware.

2.23 FINISHES AND BASE MATERIALS

A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

HARDWARE ITEM	BHMA FINISH
1. Butt Hinges: Exterior	630 (US32D - Satin Stainless Steel)
2. Butt Hinges: Interior	652 (US26D - Satin Chromium)
3. Continuous Hinges	630 (US32D - Satin Stainless Steel)
4. Flush Bolts	626 (US26D - Satin Chromium)
5. Exit Devices	626 (US26D - Satin Chromium)
6. Locks and Latches	626 (US26D - Satin Chromium)
7. Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
8. Coordinators	600 (Prime painted or mill alum.)
9. Closers	689 (Powder Coat Aluminum)
10. Protective Plates	630 (US32D - Satin Stainless Steel)
11. Overhead Stops	630 (US32D - Satin Stainless Steel)
12. Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
13. Thresholds	719 (Mill Aluminum)
14. Weather-strip, Sweeps Drip Caps	Aluminum Anodized
15. Magnetic Holders	689 (Powder Coat Aluminum)
16. Miscellaneous	626 (US26D - Satin Chromium)

2.24 KEYING

A. All cylinders and cores will be existing reused or new provided by Owner. Existing key system is Medeco utilizing large format interchangeable cores.

B. All locks under this section will be keyed by the Owner to an existing Master Key System.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, installer shall examine door frame installation to ensure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

3.2 INSTALLATION

A. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.

B. Provide blocking or reinforcement for all hardware mounted to drywall construction, including wall mounted door stops and holders.

C. Shim doors as required to maintain proper operating clearance between door and frame.

D. Install all hardware in accordance with the approved hardware schedule and manufacturer’s instructions for installation and adjustment.

E. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.

G. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.

H. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.

I. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.

J. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.

K. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.

L. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.

M. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.

N. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.

O. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.

P. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.

Q. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.

R. Adjust spring power of door closers to the minimum force required to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to ensure opening force does not exceed 5 lbs.

S. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.

T. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel-arm door closers, exit devices, etc., as required to accommodate weatherstripping.

U. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.

V. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water-resistant seal.

W. Deliver to the owner one complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.3 FIELD QUALITY CONTROL

A. After installation has been completed, the hardware supplier for locksets, door closers, exit devices and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.

B. After installation has been completed, the hardware supplier meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams. Wiring diagrams shall be opening-specific and include both a riser diagram and point to point diagram showing all wiring terminations.

3.4 ADJUSTMENT AND CLEANING

A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication recommended by the manufacturer.

B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

3.5 HARDWARE SCHEDULE

A. The following schedule of hardware groups is intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

146187 OPT0410151 VERSION 5

HW SET: 01 - Not Used

HW SET: 02

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	KEYED PRIVACY LOCK	ND52 OS-OCC	SCH
1	EA	OH STOP	90S	GLY

FUNCTION: KEYED PRIVACY LOCK (OFFICE LOCK W/ RESTORING LATCH). OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY. INSIDE BUTTON LOCKS OUTSIDE LEVER UNTIL UNLOCKED BY OUTSIDE KEY, TURNING INSIDE LEVER, OR CLOSING DOOR. INSIDE LEVER ALWAYS UNLOCKED. OUTSIDE INDICATOR DISPLAYS LOCKED/UNLOCKED STATUS.

HW SET: 03 - Not Used

HW SET: 04 - Not Used

HW SET: 05

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PASSAGE SET	L9010	SCH
1	EA	OH STOP	90S	GLY

FUNCTION: (F01) PASSAGE LATCH. LATCH RETRACTED BY LEVER EITHER SIDE. BOTH LEVERS ALWAYS UNLOCKED.

HW SET: 06

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PASSAGE SET	L9010	SCH
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER SEAL	188S	ZER

FUNCTION: (F01) PASSAGE LATCH. LATCH RETRACTED BY LEVER EITHER SIDE. BOTH LEVERS ALWAYS UNLOCKED.

HW SET: 06.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PASSAGE SET	L9010	SCH
1	EA	OH STOP	90S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	PERIMETER SEAL	188S	ZER

FUNCTION: (F01) PASSAGE LATCH. LATCH RETRACTED BY LEVER EITHER SIDE. BOTH LEVERS ALWAYS UNLOCKED.

HW SET: 07 - Not Used

HW SET: 08 - Not Used

HW SET: 09 - Not Used

HW SET: 10

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	OFFICE W/SIM RETRACT W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L9056 OS-OCC IS-LOC XL13-439	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	WALL STOP	WS406	IVE

FUNCTION: KEYED PRIVACY LOCK WITH INDICATOR. OUTSIDE LEVER LOCKED BY OUTSIDE KEY OR INSIDE TURN. OUTSIDE LEVER UNLOCKED BY INSIDE TURN, INSIDE LEVER, OUTSIDE KEY, OR CLOSING DOOR. INSIDE LEVER ALWAYS UNLOCKED.
OUTSIDE INDICATOR DISPLAYS OCCUPIED/VACANT STATUS. INSIDE INDICATOR DISPLAYS LOCKED/UNLOCKED STATUS.
KEY OVERRIDES THUMBTURN FOR EMERGENCY ACCESS.

HW SET: 11

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	OFFICE W/SIM RETRACT W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L9056 OS-OCC IS-LOC XL13-439	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: KEYED PRIVACY LOCK WITH INDICATOR. OUTSIDE LEVER LOCKED BY OUTSIDE KEY OR INSIDE TURN. OUTSIDE LEVER UNLOCKED BY INSIDE TURN, INSIDE LEVER, OUTSIDE KEY, OR CLOSING DOOR. INSIDE LEVER ALWAYS UNLOCKED.
OUTSIDE INDICATOR DISPLAYS OCCUPIED/VACANT STATUS. INSIDE INDICATOR DISPLAYS LOCKED/UNLOCKED STATUS.
KEY OVERRIDES THUMBTURN FOR EMERGENCY ACCESS.

HW SET: 12

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	OFFICE W/SIM RETRACT W/ INSIDE INDICATOR	L9056 IS-LOC XL13-439	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	WALL STOP	WS406	IVE

FUNCTION: KEYED PRIVACY LOCK WITH INDICATOR. OUTSIDE LEVER LOCKED BY OUTSIDE KEY OR INSIDE TURN. OUTSIDE LEVER UNLOCKED BY INSIDE TURN, INSIDE LEVER, OUTSIDE KEY, OR CLOSING DOOR. INSIDE LEVER ALWAYS UNLOCKED.
INSIDE INDICATOR DISPLAYS LOCKED/UNLOCKED STATUS.
KEY OVERRIDES THUMBTURN FOR EMERGENCY ACCESS.

HW SET: 13

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	OFFICE W/SIM RETRACT W/ INSIDE INDICATOR	L9056 IS-LOC XL13-439	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	90S	GLY

FUNCTION: KEYED PRIVACY LOCK WITH INDICATOR. OUTSIDE LEVER LOCKED BY OUTSIDE KEY OR INSIDE TURN. OUTSIDE LEVER UNLOCKED BY INSIDE TURN, INSIDE LEVER, OUTSIDE KEY, OR CLOSING DOOR. INSIDE LEVER ALWAYS UNLOCKED.
INSIDE INDICATOR DISPLAYS LOCKED/UNLOCKED STATUS.
KEY OVERRIDES THUMBTURN FOR EMERGENCY ACCESS.

HW SET: 14 - Not Used

HW SET: 15 - Not Used

HW SET: 16 - Not Used

HW SET: 17

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	DBL CYL STORE LOCK	L9066	SCH
2	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F14) STORE LOCK. LATCH RETRACTED BY LEVER FROM EITHER SIDE. BOTH LEVERS LOCKED OR UNLOCKED BY KEY FROM EITHER SIDE.

HW SET: 18 - Not Used

HW SET: 19

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 20

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	90S	GLY

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 20.1 - Not Used

HW SET: 21

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	WALL STOP	WS406	IVE
2	EA	PERIMETER SEAL	188S (1 EA AT STOP AND RABBET)	ZER
1	EA	DOOR BOTTOM	369	ZER
1	EA	THRESHOLD	63	ZER

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 22

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES AND SEALS	BY ACOUSTIC DOOR MFR	BYO
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.
COORDINATE HARDWARE WITH ACOUSTIC DOOR SUPPLIER.

HW SET: 22.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES AND SEALS	BY ACOUSTIC DOOR MFR	BYO
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	90S	GLY

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.
COORDINATE HARDWARE WITH ACOUSTIC DOOR SUPPLIER.

FOR DOORS WITH CAM-LIFT HINGES WITH LIFT 1/8"-1/2", USE ABH 9000 SERIES "CL" OVERHEAD STOP. DO NOT USE OVERHEAD STOP FOR DOORS WITH CAM-LIFT HINGES WITH LIFT OVER 1/2".

HW SET: 23

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER SEAL	188S (AT RATED DOORS)	ZER

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 23.1 - Not Used

HW SET: 23.2

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED (STAINLESS STEEL)	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A SRI / 4050 EDA SRI	LCN
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER SEAL	188S	ZER

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 24 - Not Used

HW SET: 25

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FLUSH BOLT	AUTOMATIC	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	WALL STOP	WS406	IVE

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 25.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FLUSH BOLT	AUTOMATIC	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	WALL STOP/HOLDER	WS40	IVE

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 25.2

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED (STAINLESS STEEL)	IVE
1	EA	FLUSH BOLT	AUTOMATIC	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	WALL STOP	WS406	IVE

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 26

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FLUSH BOLT	AUTOMATIC	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	OH STOP	90S	GLY

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 27

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FLUSH BOLT	AUTOMATIC	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	COORDINATOR	COR X FL	IVE
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7800	LCN
1	EA	PERIMETER SEAL	188S	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER
1	EA	N/C FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR	B/O

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.
ELECTRONIC HOLDER TO RELEASE UPON ACTUATION OF FIRE ALARM SYSTEM.

HW SET: 28 - Not Used

HW SET: 29 - Not Used

HW SET: 30

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM SECURITY	L9071	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER SEAL	188S	ZER

FUNCTION: (F32) CLASSROOM SECURITY LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE OR INSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 31

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	L9080	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F07) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 32

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
2	EA	FLUSH BOLT	AUTOMATIC	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	STOREROOM LOCK	L9080 RX	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	WALL STOP	WS406	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	GASKETING	429 (MOUNT PRIOR TO CLOSER)	ZER
1	EA	ASTRAGAL SEAL	488S	ZER
1	EA	WELDED OVERLAPPING ASTRAGAL	BY DOOR SUPPLIER	B/O
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
2	EA	DOOR POSITION SWITCH	679	SCE

FUNCTION: (F07) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 32.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FLUSH BOLT	AUTOMATIC	IVE
1	EA	STOREROOM LOCK	L9080	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	90S	GLY
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	GASKETING	188S	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER

FUNCTION: (F07) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 33

QTY		DESCRIPTION	CATALOG NUMBER	MFR
3	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM W/DEADBOLT W/ OUTSIDE INDICATOR	L9480 OS-OCC	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: STOREROOM LOCK WITH DEADBOLT. FIXED OUTSIDE TRIM - OUTSIDE KEY RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.
DEADBOLT ACTUATED BY OUTSIDE KEY OR INSIDE TURN. INSIDE LEVER RETRACTS DEADBOLT. OUTSIDE INDICATOR DISPLAYS OCCUPIED/VACANT STATUS CORRESPONDING TO DEADBOLT POSITION.

HW SET: 34

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	EU ELR MORTISE LOCK	L9696EU	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	ACTUATOR, HAND-WAVE	8310-810S	LCN
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: ELECTRIFIED STOREROOM LOCK WITH ELECTRONIC LATCH RETRACTION - FAIL SECURE.
LATCH RETRACTED BY KEY EITHER SIDE.
(CORRIDOR SIDE) LEVER ALWAYS FIXED/INOPERATIVE.
OUTSIDE ACTUATOR ENABLED/DISABLED BY ELECTRONIC ACCESS CONTROL SYSTEM.
LATCH ELECTRICALLY RETRACTED BY HAND-WAVE ACTUATOR FOR MOMENTARY ACCESS FROM CORRIDOR TO RECEPTION.
(RECEPTION SIDE) LEVER LOCKED/UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM.
UPON LOSS OF POWER, LATCH EXTENDS AND BOTH LEVERS REMAIN LOCKED.

HW SET: 35

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	EU STOREROOM LOCK	L9092EU RX	SCH
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER SEAL	188S (AT RATED DOORS)	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: ELECTRIFIED STOREROOM LOCK - FAIL SECURE. OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.
OUTSIDE LEVER UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM. UPON LOSS OF POWER, OUTSIDE LEVER REMAINS LOCKED.

HW SET: 36 - Not Used

HW SET: 37

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	EU STOREROOM LOCK	L9092EU RX	SCH
1	EA	SURFACE CLOSER	4050A SCUSH	LCN
1	EA	RAIN DRIP	142	ZER
1	SET	GASKETING	429 (MOUNT PRIOR TO CLOSER)	ZER
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: ELECTRIFIED STOREROOM LOCK - FAIL SECURE. OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.
OUTSIDE LEVER UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM. UPON LOSS OF POWER, OUTSIDE LEVER REMAINS LOCKED.

HW SET: 38

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
2	EA	FLUSH BOLT	AUTOMATIC	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	EU STOREROOM LOCK	L9092EU RX	SCH
1	EA	OH STOP	90S	GLY
1	EA	SURFACE CLOSER	4050A SCUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	SET	GASKETING	429 (MOUNT PRIOR TO CLOSER)	ZER
1	EA	ASTRAGAL SEAL	488S	ZER
1	EA	WELDED OVERLAPPING ASTRAGAL	BY DOOR SUPPLIER	B/O
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
2	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: ELECTRIFIED STOREROOM LOCK - FAIL SECURE. OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.
OUTSIDE LEVER UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM. UPON LOSS OF POWER, OUTSIDE LEVER REMAINS LOCKED.

HW SET: 39

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT	VON
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: DUMMY TRIM PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.
OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE LATCH IS RETRACTED.
INSIDE ACTUATOR RETRACTS LATCH AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 40

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT	VON
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	PEDESTAL	36-9C 36"	WIK
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: DUMMY TRIM PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.
OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE LATCH IS RETRACTED.
INSIDE ACTUATOR RETRACTS LATCH AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 40.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	ELECTRIC HINGE	8-WIRE AS REQUIRED	IVE
1	EA	LATCH RETRACTION KIT	QELA CONVERSION KIT - MODULAR	VON
1	EA	RX SWITCH KIT	SWITCH KIT-RX	VON
1	EA	99 SERIES LD COVER PLATE	050589	VON
1	EA	SURF. AUTO OPERATOR	9542	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	PEDESTAL	36-9C 36"	WIK
1	EA	ACCESS CONTROL CONTACT	BY SECURITY SUPPLIER	
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

PROVIDE NEW ELECTRIC LATCH RETRACTION KIT, RX SWITCH, AND COVER PLATE FOR EXISTING PANIC HARDWARE.

LATCH RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION. OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY ELECTRIC STRIKE IS UNLOCKED. INSIDE ACTUATOR UNLOCKS ELECTRIC STRIKE AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

FIELD VERIFY NEW HARDWARE IS COMPATIBLE WITH EXISTING DOOR PRIOR TO ORDERING NEW HARDWARE.

HW SET: 40.2 - Not Used

HW SET: 41

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT	VON
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	ACCESS CONTROL CONTACT	BY SECURITY SUPPLIER	
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	KEY SWITCH	BY SECURITY SUPPLIER	
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: DUMMY TRIM PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM OR KEYSWITCH FOR PUSH/PULL OPERATION.

HW SET: 42

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT	VON
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	ACCESS CONTROL CONTACT	BY SECURITY SUPPLIER	
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: DUMMY TRIM PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 42.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	ELECTRIC HINGE	8-WIRE AS REQUIRED	IVE
1	EA	LATCH RETRACTION KIT	QELA CONVERSION KIT - MODULAR	VON
1	EA	RX SWITCH KIT	SWITCH KIT-RX	VON
1	EA	99 SERIES LD COVER PLATE	050589	VON
1	EA	ACCESS CONTROL CONTACT	BY SECURITY SUPPLIER	
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

PROVIDE NEW ELECTRIC LATCH RETRACTION KIT, RX SWITCH, AND COVER PLATE FOR EXISTING PANIC HARDWARE.

LATCH RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

FIELD VERIFY NEW HARDWARE IS COMPATIBLE WITH EXISTING DOOR PRIOR TO ORDERING NEW HARDWARE.

HW SET: 42.2 - Not Used

HW SET: 43

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	POWER TRANSFER	EPT10	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	VON
2	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	OH STOP	100S	GLY
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	ACCESS CONTROL CONTACT	BY SECURITY SUPPLIER	
2	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: DUMMY TRIM PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 44

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	POWER TRANSFER	EPT10	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	VON
2	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	OH STOP	100S	GLY
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	MULLION SEAL	8780	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
2	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: DUMMY TRIM PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 44.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	POWER TRANSFER	EPT10	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	VON
2	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	OH STOP	100S	GLY
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	MULLION SEAL	8780	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
2	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: DUMMY TRIM PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 45

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	FIRE EXIT HARDWARE	9927-EO-F-LBR	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL-9927-L-NL-F-LBR	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	FIRE/LIFE HOLDER	4040SEH	LCN
2	EA	SURFACE CLOSER	4050A CUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	PERIMETER SEAL	188S	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
2	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	
1	EA	N/C FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR	B/O

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.
ELECTRONIC HOLDER TO RELEASE UPON ACTUATION OF FIRE ALARM SYSTEM.

HW SET: 46 - Not Used

HW SET: 47

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	PANIC HARDWARE	LD-9927-EO-LBR	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9927-NL-LBR	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7800	LCN
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
2	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	
	EA	ACCESS CONTROL RELAY	BY SECURITY SUPPLIER	B/O

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.
ELECTRONIC HOLDER TO RELEASE BY SIGNAL FROM ELECTRONIC ACCESS CONTROL SYSTEM.

HW SET: 48

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	POWER TRANSFER	EPT10	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-99-EO	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL	VON
2	EA	CYLINDER HOUSING	AS REQUIRED	
2	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4050A SCUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	GASKETING	429 (MOUNT PRIOR TO CLOSER)	ZER
1	EA	MULLION SEAL	8780	ZER
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
2	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 49

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.
OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE LATCH IS RETRACTED.
INSIDE ACTUATOR RETRACTS LATCH AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 50

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	INTERCOM / REMOTE RELEASE SWITCH	BY SECURITY SUPPLIER	B/O
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.
OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE LATCH IS RETRACTED.
INSIDE ACTUATOR RETRACTS LATCH AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 51

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.
OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE LATCH IS RETRACTED.
INSIDE ACTUATOR RETRACTS LATCH AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 51.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL	VON
2	EA	CYLINDER HOUSING	AS REQUIRED	
2	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	KEY SWITCH	653 AS REQUIRED	SCE
1	EA	DOOR POSITION SWITCH	679	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	VON
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH ELECTRICALLY RETRACTED BY WALL-MOUNTED KEY SWICH FOR PUSH/PULL OPERATION.
OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE LATCH IS RETRACTED.
INSIDE ACTUATOR RETRACTS LATCH AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 52

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	ELEC PANIC HARDWARE	QEL-ESL-WS-T-9927-L-DT	VON
1	EA	LATCH GUARD	WS-LGO-3 / WS-LGO-4 (AS REQUIRED PER DOOR WIDTH)	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	GASKETING	429 (MOUNT PRIOR TO CLOSER)	ZER
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER

FUNCTION: DUMMY LEVER PANIC HARDWARE. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH RETRACTION BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION. INSIDE KEY CYLINDER DISABLES ELECTRONIC LATCH RETRACTION TO MAINTAIN LATCHING DURING WINDSTORM EVENT.
NOTE: HARDWARE IS TESTED AS A COMPLETE ASSEMBLY AND MUST BE INSTALLED ON STEELCRAFT OR REPUBLIC WINDSTORM RATED DOOR TO MAINTAIN WINDSTORM RATING.

HW SET: 53

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	ELEC FIRE EXIT HARDWARE	QEL-ESL-WS-T-9927-L-DT-F	VON
1	EA	FIRE EXIT HARDWARE	WS-T-9927-EO-F	VON
2	EA	LATCH GUARD	WS-LGO-3 / WS-LGO-4 (AS REQUIRED PER DOOR WIDTH)	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4111 SCUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	PERIMETER SEAL	188S	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER

FUNCTION: DUMMY LEVER PANIC HARDWARE. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH RETRACTION BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION. INSIDE KEY CYLINDER DISABLES ELECTRONIC LATCH RETRACTION TO MAINTAIN LATCHING DURING WINDSTORM EVENT.
NOTE: HARDWARE IS TESTED AS A COMPLETE ASSEMBLY AND MUST BE INSTALLED ON STEELCRAFT OR REPUBLIC WINDSTORM RATED DOOR TO MAINTAIN WINDSTORM RATING.

HW SET: 54

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PANIC HARDWARE	LD-WS-T-9927-EO	VON
1	EA	ELEC PANIC HARDWARE	QEL-ESL-WS-T-9927-L-KC	VON
2	EA	LATCH GUARD	WS-LGO-3 / WS-LGO-4 (AS REQUIRED PER DOOR WIDTH)	VON
2	EA	CYLINDER HOUSING	AS REQUIRED	
2	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4111 SCUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	GASKETING	429 (MOUNT PRIOR TO CLOSER)	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER

FUNCTION: KEY CAPTURE LEVER PANIC HARDWARE. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS. OUTSIDE LEVER RETRACTS LATCH ONLY WHILE KEY IS INSERTED IN OUTSIDE TRIM. REMOVING KEY LOCKS OUTSIDE TRIM.
LATCH RETRACTION BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION. INSIDE KEY CYLINDER DISABLES ELECTRONIC LATCH RETRACTION TO MAINTAIN LATCHING DURING WINDSTORM EVENT.
NOTE: HARDWARE IS TESTED AS A COMPLETE ASSEMBLY AND MUST BE INSTALLED ON STEELCRAFT OR REPUBLIC WINDSTORM RATED DOOR TO MAINTAIN WINDSTORM RATING.

HW SET: 55

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-99-EO	VON
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	DOOR POSITION SWITCH	679	SCE

FUNCTION: EXIT-ONLY PANIC HARDWARE - NO OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.

HW SET: 56

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PANIC HARDWARE	LD-99-EO	VON
1	EA	SURFACE CLOSER	4050A SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE

FUNCTION: EXIT ONLY PANIC HARDWARE - NO OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.

HW SET: 57

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	POWER TRANSFER	EPT10	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-99-EO	VON
1	EA	SURFACE CLOSER	4050A SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	8655	ZER
1	EA	DOOR POSITION SWITCH	679	SCE

FUNCTION: EXIT-ONLY PANIC HARDWARE - NO OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.

HW SET: 58

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FIRE EXIT HARDWARE	9927-EO-F-LBR	VON
1	EA	FIRE EXIT HARDWARE	9927-EO-F-LBRAFL	VON
2	EA	FIRE/LIFE HOLDER	4040SEH	LCN
2	EA	SURFACE CLOSER	4050A CUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	PERIMETER SEAL	188S	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER
1	EA	N/C FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR	B/O

FUNCTION: EXIT-ONLY PANIC HARDWARE - NO OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
ELECTRONIC HOLDER TO RELEASE UPON ACTUATION OF FIRE ALARM SYSTEM.

HW SET: 59 - Not Used

HW SET: 60 - Not Used

HW SET: 61

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED (STAINLESS STEEL)	IVE
1	EA	PANIC HARDWARE	LD-99-L	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A SRI / 4050 EDA SRI	LCN
1	EA	WALL STOP	WS406	IVE

FUNCTION: LEVER EXIT HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: 61.1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED (STAINLESS STEEL)	IVE
1	EA	PANIC HARDWARE	LD-99-L	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050 SCUSH SRI	LCN

FUNCTION: LEVER EXIT HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: 61.2 - Not Used

HW SET: 62 - Not Used

HW SET: 63 - Not Used

HW SET: 64 - Not Used

HW SET: 65 - Not Used

HW SET: 66

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FIRE EXIT HARDWARE	9927-EO-F-LBRAFL	VON
1	EA	FIRE EXIT HARDWARE	9927-L-F-2SI-LBR	VON
2	EA	CYLINDER HOUSING	AS REQUIRED	
2	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	RIM CYL THUMBTURN	XB11-979 (INSIDE)	SCH
2	EA	FIRE/LIFE HOLDER	4040SEH	LCN
2	EA	SURFACE CLOSER	4050A CUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	PERIMETER SEAL	188S	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER
1	EA	N/C FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR	B/O

FUNCTION: CLASSROOM PANIC HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY OR BY INSIDE TURN. INDICATOR ON INSIDE CENTER CASE DISPLAYS LOCKED/UNLOCKED STATUS OF OUTSIDE LEVER. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: 67

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FIRE EXIT HARDWARE	9927-EO-F-LBRAFL	VON
1	EA	FIRE EXIT HARDWARE	9927-L-F-LBR	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7800	LCN
1	EA	PERIMETER SEAL	188S	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER
	EA	N/C FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR	B/O

FUNCTION: CLASSROOM LEVER PANIC HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE OR INSIDE KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS. ELECTRONIC HOLDER TO RELEASE UPON ACTUATION OF FIRE ALARM SYSTEM.

HW SET: 68 - Not Used

HW SET: 69

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	PANIC HARDWARE	CD-9927-L-LBR	VON
4	EA	CYLINDER HOUSING	AS REQUIRED	
4	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	WALL STOP	WS406	IVE

FUNCTION: CLASSROOM PANIC HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.
LATCH DOGGED BY INSIDE CYLINDER FOR PUSH/PULL OPERATION.

HW SET: 70

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FIRE EXIT HARDWARE	9927-EO-F-LBRAFL	VON
1	EA	FIRE EXIT HARDWARE	9927-L-BE-F-LBR	VON
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7800	LCN
1	EA	PERIMETER SEAL	188S	ZER
2	EA	MEETING STILE SEAL	8193 (1 EA LEAF)	ZER
	EA	N/C FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR	B/O

FUNCTION: PASSAGE LEVER PANIC HARDWARE. OUTSIDE LEVER ALWAYS UNLOCKED. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.
ELECTRONIC HOLDER TO RELEASE UPON ACTUATION OF FIRE ALARM SYSTEM.

HW SET: 71

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	PANIC HARDWARE	CD-9927-L-BE-LBR	VON
2	EA	CYLINDER HOUSING	AS REQUIRED	
2	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	WALL STOP	WS406	IVE

FUNCTION: PASSAGE PANIC HARDWARE. OUTSIDE LEVER ALWAYS UNLOCKED. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.
LATCH DOGGED BY INSIDE CYLINDER FOR PUSH/PULL OPERATION.

HW SET: 72

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PANIC HARDWARE	LD-99-L-NL	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: NIGHT LATCH EXIT HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: 73

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PANIC HARDWARE	LD-99-L-NL	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE

FUNCTION: NIGHT LATCH EXIT HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: 74

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	FIRE EXIT HARDWARE	99-L-NL-F	VON
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	SURFACE CLOSER	4050A SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	PERIMETER SEAL	188S	ZER

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.

HW SET: 75

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	VON
1	EA	PANIC HARDWARE	LD-99-EO	VON
1	EA	PANIC HARDWARE	LD-99-L-NL	VON
2	EA	CYLINDER HOUSING	AS REQUIRED	
2	EA	KEY CYLINDER CORE	AS REQUIRED	
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	WALL STOP	WS406	IVE

FUNCTION: NIGHT LATCH EXIT HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: 76

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	PUSH PLATE	8200 6" X 16"	IVE
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	WALL STOP/HOLDER	WS40	IVE

FUNCTION: PUSH/PUSH.

HW SET: 77

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PUSH/PULL BAR	9103 10"	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN

FUNCTION: PUSH/PULL.
INSIDE OR OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR.

HW SET: 78

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PUSH/PULL BAR	9103 10"	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN

FUNCTION: PUSH/PULL.

HW SET: 79

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	PUSH/PULL BAR	9103 10"	IVE
2	EA	OH STOP	100S	GLY
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN

FUNCTION: PUSH/PULL.

HW SET: 80

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	SLIDING DOOR HARDWARE	C-411-W KIT	KNC
1	EA	SLIDING DOOR LOCK	2001ADAP-2	ACC
2	EA	KEY CYLINDER CORE	AS REQUIRED	

FUNCTION: SLIDING POCKET DOOR. INSIDE OR OUTSIDE KEY LOCKS/UNLOCKS DOOR.

HW SET: 81

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	SLIDING DOOR HARDWARE	C-411-W KIT	KNC
1	EA	BACK-BACK PULLS	7200P	ACC

FUNCTION: SLIDING POCKET DOOR.

HW SET: 82

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PUSH PLATE	8200 6" X 16"	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	IVE
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: PUSH/PULL.

HW SET: 83

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	PUSH PLATE	8200 6" X 16"	IVE
2	EA	PULL PLATE	8303 10" 4" X 16"	IVE
2	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	WALL STOP	WS406	IVE

FUNCTION: PUSH/PULL.

HW SET: 84

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CYLINDER HOUSING	AS REQUIRED	
1	EA	KEY CYLINDER CORE	AS REQUIRED	
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
	EA	REMAINING HARDWARE	BY INTEGRATED DOOR SUPPLIER	

FUNCTION: CLASSROOM PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. OUTSIDE LEVER LOCKED/UNLOCKED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS. LATCH ELECTRICALLY RETRACTED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.
ELECTRONIC HOLD-OPEN HOLDS DOORS OPEN DURING HOURS OF OPERATION.
ELECTRONIC HOLD-OPEN TO RELEASE UPON ACTUATION OF FIRE ALARM SYSTEM OR SIGNAL FROM ELECTRONIC ACCESS CONTROL SYSTEM.

HW SET: 85

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	ALL HARDWARE	BY INTEGRATED DOOR SUPPLIER	B/O

FUNCTION: PASSAGE PANIC HARDWARE. OUTSIDE LEVER ALWAYS UNLOCKED. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.
ELECTRONIC HOLD-OPEN HOLDS DOORS OPEN DURING HOURS OF OPERATION.
ELECTRONIC HOLD-OPEN TO RELEASE UPON ACTUATION OF FIRE ALARM SYSTEM OR SIGNAL FROM ELECTRONIC ACCESS CONTROL SYSTEM.

HW SET: 85.1 - Not Used

HW SET: 85.2 - Not Used

HW SET: 86

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	ALL HARDWARE	BY DOOR SUPPLIER	B/O

HW SET: 87

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	DOOR POSITION SWITCH	679	SCE
	EA	REMAINING HARDWARE	EXISTING	

HW SET: 88

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	DOOR CONTACT	674-OH	SCE
	EA	REMAINING HARDWARE	EXISTING	

HW SET: 89

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	SURF. DOOR POSITION SWITCH	7766	SCE
	EA	REMAINING HARDWARE	EXISTING	

HW SET: 90

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
	EA	REMAINING HARDWARE	EXISTING	

HW SET: 91

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	FIRE/LIFE WALL MAG	SEM7800 (AS REQUIRED)	LCN
	EA	ACCESS CONTROL RELAY	BY SECURITY SUPPLIER	B/O
	EA	REMAINING HARDWARE	EXISTING	

INTEGRATE MAGNETIC HOLD OPEN INTO ACCESS CONTROL SYSTEM TO AUTOMATICALLY CLOSE DOORS UPON SIGNAL FROM ACCESS CONTROL SYSTEM.

HW SET: 92

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	CYLINDER HOUSING	AS REQUIRED	
2	EA	KEY CYLINDER CORE	AS REQUIRED	
	EA	REMAINING HARDWARE	BY FIRE-RATED STOREFRONT SUPPLIER	

FUNCTION: CLASSROOM PANIC HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY OR BY INSIDE TURN. INDICATOR ON INSIDE CENTER CASE DISPLAYS LOCKED/UNLOCKED STATUS OF OUTSIDE LEVER. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: B603

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HARDWARE	SALVAGE AND REUSE	

SALVAGE AND REUSE EXISTING DOOR HARDWARE WITH NEW HARDWARE MODIFICATIONS FOR NEW DOOR PER "SALVAGE AND REINSTALLED" DOOR SCHEDULE.

HW SET: S&R

QTY	DESCRIPTION	CATALOG NUMBER	MFR
EA	HARDWARE	SALVAGE AND REUSE	

SALVAGE AND REUSE EXISTING DOOR HARDWARE WITH NEW HARDWARE MODIFICATIONS FOR NEW DOOR PER "SALVAGE AND REINSTALLED" DOOR SCHEDULE.

END OF SECTION

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic insulation.
E. Gypsum sheathing.
F. Cementitious backing board.
G. Gypsum wallboard.
H. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
C. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
D. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2024.
J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
K. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
L. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.
M. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018 (Reapproved 2023).
N. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).

O. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
P. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2024.
Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
R. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
S. ASTM E413 - Classification for Rating Sound Insulation; 2022.
T. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
U. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.
V. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
B. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Gypsum Association File Numbers: Comply with requirements of GA-234 and GA-600 for the particular assembly.
   2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
B. Basis of Design: ClarkDietrich; www.clarkdietrich.com.
C. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements - Metal Framing, Connectors, and Accessories:
   1. MarinoWARE: www.marinoware.com/#sle.
   2. SCAFCO Corporation: www.scafco.com.
   3. Steel Construction Systems: www.steelconsystems.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.
D. Nonstructural Framing System Components: AISI S220; 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/120 at 5 psf (L/120 at 240 Pa).

1. Provide minimum CP 90 corrosion protection where installed in exterior applications and humid environments.
2. Studs: "C" shaped with flat or formed webs with knurled faces.
    a. (MET STUD-2): Provide 20 gauge studs unless noted otherwise.
3. Runners: U shaped, sized to match studs.
4. Furring Members (FUR-1): Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
5. Furring (FUR-2): 'Z' furring channels. See drawings for depth.

E. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
1. C-H Studs (MET STUD-5): Gauge as required by UL listing.

F. Thermal Sub-Framing Spacer (FUR-5): Pultruded fiber glass and thermoset resin insulation clip.
1. Spacer Thickness: 3/16 inches, nominal.
2. Spacer Depth: As indicated in drawings. Provide manufacturer's recommended corrosion resistant fasteners.
3. Provide 'Z' furring channels as indicated on the drawings and as specified above.
4. Basis of Design:
    a. Advanced Architectural Products SMARTci Systems: GreenGirt-Simple Z; www.smartcisystems.com.
    b. Cascadia Windows, Inc: Cascadia Clip; www.cascadiaclip.com.
    c. exoGIRT; www.exo-girt.com.
    d. Knight Wall Systems: KWS MFI System Cladding Attachment; knightwallsystems.com.
    e. Northern Facades; ISO Clip: www.northernfacades.com.
    f. Strongwell: Strongirt; www.strongirt.com.
    g. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Material ID:
    a. (GYP BD-1): 5/8 inch Type X.
    b. (GYP BD-2): 1/2 inch.
2. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Basis of Design: USG Corporation; Sheetrock Brand EcoSmart Gypsum Panels: www.usg.com.
5. Other Acceptable Paper-Faced Products provided they meet or exceed the Basis of Design performance requirements:
    a. CertainTeed Corporation; Type X Drywall: www.certainteed.com.
    b. Georgia-Pacific Gypsum; ToughRock: www.gpgypsum.com.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

B. Impact Rated Wallboard (GYP BD-10): Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C1629.
1. Locations: As indicated on drawings.
2. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.

3. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
5. Type: Fire-resistance-rated Type X, UL or WH listed.
6. Thickness: 5/8 inch (16 mm).
7. Edges: Tapered.

C. Backing Board For Wet Areas:
1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
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. Basis of Design: USG Corporation; Durock Brand Cement Board with EdgeGuard: www.usg.com.
   b. Thickness (CEM BD-2): 5/8 inch (15.9 mm).
   c. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
      1) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: www.goldbondbuilding.com/#sle.
      2) Substitutions: See Section 01 6000 - Product Requirements.
3. Glass Mat Faced Board: Tile backing at non-wet areas. Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Regular Type (GYP BD-16): Thickness: 5/8 inch (15.9 mm).
   b. Basis of Design: USG Corporation; Durock Brand Glass Mat Tile Backer Board: www.usg.com.
   c. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
      1) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: www.goldbondbuilding.com.
      2) Substitutions: See Section 01 6000 - Product Requirements.

D. 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 X Thickness (GYP BD-6): 5/8 inch (16 mm).
3. Edges: Tapered.
4. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
   a. Living Building Challenge Red List Free or Compliant.
   b. Declare Label.
   c. Environmental Product Declaration (EPD).
   d. Health Product Declaration (HPD).
5. Basis of Design: USG Corporation; Sheetrock Brand Mold Tough EcoSmart.
6. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
   a. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.

1. Application: Exterior sheathing, unless otherwise indicated.
2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
3. Core Type: Type X.
4. Type X Thickness (GYP SHTG-2): 5/8 inch (16 mm).
5. Edges: Square.
6. Basis of Design: USG Corporation; Securerock Brand Ultralight Glass-Mat Sheathing: www.usg.com.
7. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
    a. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com.
    b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: www.goldbondbuilding.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

F. Shaftwall and Coreboard (GYP BD-20): Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Basis of Design: USG Corporation; Sheetrock Brand Glass-Mat Liner Panels Mold Tough: www.usg.com.
3. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
    a. CertainTeed Corporation; GlasRoc Shaftliner Type X: www.certainteed.com.
    b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Shaftliner: www.goldbondbuilding.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation (INSUL-80): ASTM C665; preformed fiber glass or mineral fiber, friction fit type, unfaced. Thickness: 3-1/2 inch (84 mm), minimum. Insulation should fill the cavity.
1. Basis of Design: Owens Corning Unfaced Ecotouch Insulation.
    a. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements.

B. (INSUL-81) Sound Attenuation Fire Batts (SAFB): ASTM C423; performed mineral fiber, friction fit type, unfaced. Thickness: As indicated in the drawings or to fill the cavity unless noted otherwise.
1. Basis of Design: Johns Manville SAFB.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

D. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
1. Reveal Molding (MT-#): Basis of Design: As indicated on drawings.
    a. Types: As detailed or required for finished appearance.

E. Non-parabolic Cyclorama Seamless Joints (GYP ACC-1): Non-parabolic sound reflecting system; ABS Plastic:

1. Basis of Design: Pro Cyc; System Super 2.5EZ: www.ProCyc.com.
2. Floor Cove: 30 inch radius.
3. Expansion: 12 inch flat.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.
2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with GA-600 requirements.
1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.
2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

C. Studs: Space studs at 16 inches on center (at 406 mm on center).
1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.

F. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

3.04 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.
1. Place continuous bead at perimeter of each layer of gypsum board.
2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 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. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

F. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
2. Provide a control joint at both sides of the wall at every door frame. Locate at hinge side of door.
3. Provide a control joint at both sides of the wall at openings in the wall. Provide on one side of the opening for openings 48 inches wide or less. For openings over 48 inches, provide on both sides of the opening.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish, walls called out to have vinyl graphics applied and other areas specifically indicated.
2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

D. 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).

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 3000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.

B. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

C. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

D. 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.

E. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.

F. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.

G. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2012.

H. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

I. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Provide two tiles, actual size, illustrating pattern and color.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

E. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Tile: 10 sq ft (1 sq m) of each size, color, and surface finish combination.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 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.

1.08 WARRANTY

A. Tile and Stone Installation System Warranty: Manufacturer's standard system warranty protecting against break down or deterioration of the tile setting system under normal usage, and ensuring the products are free from manufacturer defects. Manufacturer shall pay for replacement of its own products and replacement of finishing materials, including labor, for defective portions of the project.

1. Warranty Period: 25 years.

PART 2 PRODUCTS

2.01 TILE

A. Tile (T-#): ANSI A137.1 standard grade.

1. Basis of Design: See drawings for product information.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim (MT-#): Brushed stainless steel, style and dimensions to suit application, set with tile mortar or adhesive.

1. Basis of Design: See drawings for product information.

2.03 SETTING MATERIALS

A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.

1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
    a. Typical Floors:
        1) LATICRETE 254 Platinum.
        2) TEC Specialty Full Flex.
    b. Typical Walls:
        1) LATICRETE Tri Lite.
        2) TEC Specialty Ultimate Large Tile.
2. Products:
    a. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
    b. LATICRETE International, Inc: www.laticrete.com/#sle.
    c. Mapei Corporation: www.mapei.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

A. High Performance Polymer Modified Grout (GT-#): ANSI A118.7 polymer modified cement grout.

1. Applications: Use this type of grout for typical walls.

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: As selected by Architect from manufacturer's full line.
4. Basis of Design:
    a. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
    b. LATICRETE International, Inc; LATICRETE PERMACOLOR Select Grout: www.laticrete.com/#sle.
    c. Mapei Corporation; Ultracolor Plus FA: www.mapei.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Grout (GT-#): ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Use where indicated on drawings.
2. Color: As selected by Architect from manufacturer's full line.
3. Basis of Design:
    a. Tile Floors:
        1) H.B. Fuller Construction Products, Inc; TEC AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com.
        2) LATICRETE International, Inc; LATICRETE SpectraLOCK PRO Premium Grout.
        3) Mapei Corporation: www.mapei.com.

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. Color: As selected by Architect from manufacturer's full line.
3. Products:
    a. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
    b. TEC Specialty; Silicone Caulk.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORY MATERIALS

A. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Application: Provide at walls, ceilings and floors in showers only.
2. Fluid or Trowel Applied Type:
    a. Products:
        1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
        2) TEC Specialty; HydraFlex.
        3) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.
B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108/A118/A136, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated on drawings. 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 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 non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated on drawings. Use standard grout unless otherwise indicated on drawings.

K. 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.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F115, with epoxy grout. Provide waterproofing membrane under all tile.

1. Use uncoupling membrane under tile unless other underlayment is indicated on drawings.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.

B. Grout with standard grout.

3.06 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

B. Over gypsum wallboard on wood or metal studs, install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Divisions 21 through 28 for mechanical and electrical components in acoustical ceilings.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG Corporation: www.usg.com/ceilings.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Rockfon, LLC: www.rockfon.com.
   4. USG Corporation: www.usg.com/ceilings.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: As specified in Section 01 6116.

B. Acoustical Panels (ACT-#): Painted mineral fiber:
   1. Basis of Design: As indicated on drawings.

2.03 SUSPENSION SYSTEMS

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. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
   1. Structural Classification: Intermediate-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.
   5. Products:
      a. USG Corporation; Donn Brand DX/DXL Suspension System: www.usg.com.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Perimeter Moldings: Same metal and finish as grid.
   1. Size: As required for installation conditions.
   2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions, as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.
2. Miter corners.

E. 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.

F. 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.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

3.03 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 acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.
2. Double cut and field paint exposed reveal edges.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.

G. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 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 5426 - SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended wood ceilings.

B. Metal suspension system.

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings: Metal suspension systems.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

G. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

H. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

I. CISCA (WC) - Wood Ceilings Technical Guidelines; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on wood ceiling components and suspension system components.

D. Samples: Submit two full size samples illustrating material and finish of wood ceiling components.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Designer's qualification statement.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.

1.06 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform design under direct supervision of Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.

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

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood ceiling components to project site in original, unopened packages.

B. Store in fully enclosed space, flat, level and off the floor.

1.09 FIELD CONDITIONS

A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

PART 2 PRODUCTS

2.01 SUSPENDED WOOD CEILING SYSTEM

A. Performance Requirements:
   1. Design for maximum deflection of 1/360 of span.

B. Wood-Based Materials:
   1. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.
   2. Composite Wood Panels: Containing no urea-formaldehyde resin binders.

C. Suspended Wood Ceilings (WCT-#):
   1. Basis of Design: As indicated on drawings.

2.02 FABRICATION

A. Shop fabricate wood ceiling components to the greatest extent possible.

B. Fabricate components to allow access to ceiling plenum as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not install ceiling until after interior wet work is dry.

3.02 PREPARATION

A. Coordinate the location of hangers with other work.

B. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

C. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.

D. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.03 INSTALLATION

A. General: Install suspended wood ceiling system in accordance with CISCA (WC).

B. Suspension System:

1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
3. 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.
4. 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.
5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
6. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
7. Do not eccentrically load system or induce rotation of runners.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

D. Wood Ceiling:

1. Install wood ceilings in accordance with manufacturer's instructions.
2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
3. Install components in uniform plane, and free from twist, warp, and dents.
4. Cut to fit irregular grid and perimeter edge trim.
5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

3.05 CLEANING

A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION

SECTION 09 6500 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.
B. Resilient tile flooring.
C. Resilient base.
D. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
B. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2022.
C. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004 (Reapproved 2021).
D. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2021a.
E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).
F. ASTM F2195 - Standard Specification for Linoleum Floor Tile; 2018 (Reapproved 2023).
G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
E. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Flooring Material: 100 square feet (9.29 square meters) of each type and color.
    3. Extra Wall Base: 20 linear feet (6.1 linear meters) of each type and color.

1.05 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) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.06 WARRANTY

A. Manufacturer's standard limited 5 year commercial warranty.

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Vinyl Sheet Flooring (VSF-#): Color and pattern throughout wear layer thickness, with backing:
   1. Basis of Design: See drawings for product information.
   2. Minimum Requirements: Comply with ASTM F1303, Type II, with Class A fibrous backing.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648, NFPA 253, ASTM E648, or NFPA 253.
   4. Wear Layer Thickness: 0.020 inch (0.51 mm) minimum.
   5. Total Thickness: 0.080 inch (2.0 mm) minimum.
   6. Sheet Width: 72 inch (1830 mm) minimum.
   7. Static Load Resistance: 125 psi (860 kPa) minimum, when tested as specified in ASTM F970.
   8. (VSFB-#) Integral coved base with cap strip.

2.02 TILE FLOORING

A. Rubber Tile (RBT-#): Type I- Homogeneous, color and pattern throughout thickness; Type II- Heterogeneous, laminated.
   1. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
   2. Size: 18 by 18 inch (457 by 457 mm) nominal.
   3. Total Thickness: 0.125 inch (3.2 mm).

B. Luxury Vinyl Tile (LVT-#): Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
   1. Basis of Design: See drawings for product information.
   2. Minimum Requirements: Comply with ASTM 1700, Class 3 Type B.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648, NFPA 253, ASTM E648, or NFPA 253.
   4. Backing: Synthetic fabric.
   5. Thickness: 0.100 inch (2.5 mm), minimum, excluding backing.

2.03 RESILIENT BASE

A. Resilient Base (RB-#): ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
   1. Basis of Design: See drawings for product information.
   2. Height: 4 inches (100 mm).
   3. Thickness: 0.125 inch (3.2 mm).
   4. Finish: Satin.
   5. Length: Roll.

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. Moldings, Transition and Edge Strips (RTS-#): Same material as resilient base.

D. Filler for Coved Base: Plastic.

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. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is fully cured.

C. Clean substrate.

D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

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.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

B. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.05 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, unless indicated otherwise in drawings.

3.06 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.

C. Scribe and fit to door frames and other interruptions.

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 6566 - RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rubber sheet flooring, adhesively installed.

1.02 SUBMITTALS

A. See Section 01 3000 - 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. Verification Samples: Actual flooring material specified, not less than 12 inch (305 mm) square, mounted on solid backing.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.04 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.

1.05 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 FLUID-APPLIED ATHLETIC FLOORING

A. Polyurethance Flooring Over Rubberized Base Mat (RAF-#):

1. Basis of Design: Pulastic Classic 110: www.pulastic.sika.com.
2. Total System Thickness: Minimum 1/4 inch (6.4 mm); with minimum 0.07 inch (1.8 mm) polyurethane.
3. Base Mat: Prefabricated rubber mat of recycled rubber granules in polyurethance binder.
4. Sealer: Manufacturer's standard two-component polyurethane compound designed to seal base mat before application of resin topcoat.
5. Resin: Two-component, solid, pigmented, self-leveling polyurethane without fillers, zero mercury formulation, with properties as follows:
   a. Tensile Strength: Minimum 1000 psi (6.9 MPa), per ASTM D412.
   b. Durometer Hardness, Type A: Minimum of 70, when tested in accordance with ASTM D2240.
   c. Ultimate Elongation: Minimum 100 percent
6. Finish: Manufacturer's standard pigmented two-component polyurethane topcoat, matte finish, in color as selected from manufacturer's standard range.

2.02 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

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 and approved shop drawings.

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 6623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Epoxy matrix terrazzo with ground and polished finish.

B. Divider strips.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete subfloor with steel trowel finish.

B. Section 09 9600 - High-Performance Coatings: Slip resistant coating applied to terrazzo flooring.

1.03 REFERENCE STANDARDS

A. NTMA (GRAD) - Aggregate Gradation Standards; Current Edition.

B. NTMA (EPOXY) - Epoxy Terrazzo Specifications; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for divider strips, control joint strips, expansion joints, and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.

C. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.

D. Samples: Submit two samples, 12 inch (304 mm) by 12 inch (305 mm) in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.

E. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store terrazzo materials in a dry, secure area.

B. Maintain minimum temperature of 60 degrees F (16 degrees C).

C. Keep products away from fire or open flame.

1.07 FIELD CONDITIONS

A. Do not install terrazzo when temperature is below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

C. Provide ambient lighting level of 50 ft candles (540 lx), measured at floor surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Resinous Matrix Terrazzo Flooring:

1. Key Resin Company: www.keyresin.com.

2. Sherwin-Williams High Performance Flooring: www.sherwin-williams.com/resin-flooring.
3. Terrazzo & Marble Supply Companies: www.tmsupply.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Floors (TERR-1):
1. Thickness: 3/8 inch (9 mm), nominal.

2.03 MATERIALS

A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.
1. Mix Proportions: As required to achieve appearance specified.
B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.
C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.
D. Finishing Grout: Epoxy, color to match terrazzo matrix.

2.04 ACCESSORIES

A. Divider Strips (MT-#): 1/8 inch (3 mm) thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.
B. Control Joint Strips: 1/8 inch (3 mm) nominal width zinc exposed top strips, zinc coated steel concealed bottom strips, 1/8 inch (3 mm) wide neoprene filler strip between vertical strips, with anchoring features.
C. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.
D. Crack Suppression Membrane: Provide manufacturer's recommended crack suppression system under all terrazzo.
E. Base Cap, Base Divider Strip, and Separator Strip: Match divider strips.
F. Non-Slip Inserts: Provide channel-shaped inserts filled with a mixture of resin and fine, abrasive aggregate.
G. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.
H. Wood Subfloor Filler: Latex type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.
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 terrazzo.
C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
D. Cementitious Subfloor Surfaces: Verify that substrates are ready for terrazzo flooring installation by testing for moisture and alkalinity (pH).
1. Obtain instructions if test results are not within limits recommended by terrazzo flooring manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Clean substrate of foreign matter.

B. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.

C. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install control joint strips straight and flat to locations indicated.

B. Install divider strips according to pattern approved on shop drawings.

C. Install recessed floor mat frames.

D. Install base and border divider and control joint strips to match floor pattern.

E. Install terminating cap strip at top of base; attach securely to wall substrate.

F. Place terrazzo mix over substrate to thickness indicated.

3.04 FINISHING

A. Finish terrazzo to NTMA requirements.

B. Produce terrazzo finish surface to match approved mock-up, with 70 percent chip exposed.

C. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.

D. Apply grout to fill voids exposed from grinding.

E. Remove grout coat by grinding, using a fine grit abrasive.

F. Hand grind vertical and curved surfaces similarly.

3.05 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet (6 mm in one m).

B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch (3 mm).

3.06 CLEANING

A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.

B. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.

C. Polish surfaces in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION

SECTION 09 6700 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.02 RELATED REQUIREMENTS

A. Section 09 9600 - High-Performance Coatings: Base coating for fluid-applied flooring.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

E. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Top Coat Materials: 2 gallons (8 liters).

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section.

1. Minimum five years of documented experience.
2. Approved by manufacturer.

1.05 MOCK-UPS

A. Mock-ups: Before installing fluid-applied flooring, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mock-ups in areas indicated by Construction Manager (areas not intended for fluid-applied flooring, but used for the mockup, such as a janitor's closet. Anticipate that a minimum of three mockups will be required. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Obtain Architect's approval of mockups before installing flooring in other areas.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:

1. Tnemec, Inc: www.tnemec.com.
2. Key Resin Company: www.keyresin.com/#sle.
3. Sherwin-Williams Company: High Performance Flooring: www.generalpolymers.com/#sle.
4. Stonhard: www.stonhard.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

A. Fluid-Applied Flooring (HPF-#): Cementitious-urethane flooring system with quartz aggregate.

1. Basis of Design: As indicated on drawings.
2. Primer: Manufacturer's recommended primer.
3. Thickness: 2 mm, nominal when dry.
4. Texture: Smooth.
5. Aggregate: Brightly colored quartz broadcast aggregate.
6. Aggregate size: 1/16 inch flakes.
7. Base: Integral cove base; seamless with floor.
8. Color: As indicated on drawings.

2.03 ACCESSORIES

A. Base Caps: Zinc with projecting base of 1/8 inch (3 mm); color as selected.

B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

C. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

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 flooring.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

D. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Finish to smooth level surface.

D. Cove at vertical surfaces.

3.04 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

END OF SECTION

SECTION 09 6813 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tile Carpeting (CPT-#): Each type manufactured in one color dye lot.

1. See drawings for schedule of carpet tiles.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Rubber, color as selected by Architect.

C. Adhesives:

1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

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 subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

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.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Trim carpet tile neatly at walls and around interruptions.

F. 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 7200 - WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall covering.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for wall covering and adhesive. Indicate compliance with specified flame spread and smoke developed ratings.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Manufacturer's Instructions: Indicate installation special procedures.

E. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in project maintenance:

1. See Section 01 6000 - Product Requirements for additional provisions.
2. Extra Stock Materials: 25 feet (8 m) of each color and pattern of wall covering.
    a. Package and label each roll by manufacturer, color, pattern, and destination room number.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials for damage upon arrival.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.06 FIELD CONDITIONS

A. Maintain adhesive and wall covering manufacturer's recommended temperature ranges 24 hours before, during, and after installation.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. Performance Requirements:

1. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 50, maximum, when tested in accordance with ASTM E84.

B. Wall Covering (WC-#): Fabric-backed vinyl roll stock; Type II.

1. Basis of Design: See drawings for product information.

2.02 ACCESSORIES

A. Adhesive: Type recommended by wall covering manufacturer.

B. 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 ready to receive work, and conform to requirements of the wall covering manufacturer.

B. Measure moisture content of substrates with electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) or at rate greater than 1/16 inch/ft (5 mm/m).

D. Notify Architect of detrimental conditions affecting wall covering installation.

E. Correct detrimental conditions before starting installation.

3.02 PREPARATION

A. Remove wall plates and accessories impeding wall covering installation.

B. Substrate Priming and Preparation:

1. Fill cracks in substrate and correct irregularities with filler; sand smooth.
2. For marks capable of bleeding through surface finishes, seal with shellac.
3. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

C. Wash impervious surfaces with tetra-sodium phosphate; rinse and neutralize; wipe dry.

D. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings before preparing surfaces or finishing.

E. Correct surface defects affecting work of this section and clean surfaces. Remove existing coatings exhibiting loose surface defects.

F. Vacuum surfaces to remove loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall immediately before applying wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges of wall covering. Do not razor trim on gypsum board surfaces.

E. Smoothly apply wall covering without wrinkles, gaps, or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

F. Butt edges tightly.

G. Horizontal seams are not permitted.

H. Do not seam within 2 inches (51 mm) of internal corners or within 6 inches (152 mm) of external corners.

I. Install wall covering before installing bases and items attached to, abutting, or located within 1 inch (25 mm) of wall surface.

J. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

K. Cover spaces above and below windows and above doors in pattern sequence from roll.

L. Where wall covering tucks into reveals, metal wallboard, or plaster stops, use contact adhesive within 6 inches (152 mm) of wall covering termination. Ensure complete contact bond.

M. Remove excess adhesive from seams while wet and before proceeding to next wall covering sheet.

N. Reinstall wall plates and accessories removed to accommodate work of this section.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Clean wall coverings of dust, dirt, excess adhesive, and other contaminants.

3.05 PROTECTION

A. Protect installed products from damage until Substantial Completion.

END OF SECTION

SECTION 09 7800 - INTERIOR WALL PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative plastic wall paneling.

B. Accessories.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's descriptive literature for each specified product. Include anchorage devices specific to project substrate types.

C. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.

D. Samples: Submit two 12-inch (300 mm) long frames; finish as specified.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.

B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 DECORATIVE PLASTIC WALL PANELING

A. Decorative Plastic Wall Paneling (DPNL-#):

1. Basis of Design: As indicated on drawings.
2. Surface Texture: Smooth.
3. Printed Images: Digitally printed pattern images with manufacturer's standard scratch-resistant, UV-resistant protective coating.
    a. Custom Image: As indicated on drawings.
4. Edges: Square.

B. Accessories:

1. Adhesive: Type recommended by panel manufacturer.
2. Sealant: Type recommended by paneling manufacturer; clear.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces for adhered items are clean and smooth.

1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer.

B. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install panels in accordance with manufacturer's instructions.

B. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.

C. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.
D. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.
E. Install panels with manufacturer's recommended gaps for panel field and corner joints.
F. Install trim with adhesive.
G. Seal joints at wall base and between panels with approved sealant to prevent moisture intrusion.
H. Remove excess sealant after paneling is installed and prior to curing.

3.03 CLEANING

A. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals for closeout submittals.

3.05 PROTECTION

A. Protect installed interior wall paneling from subsequent construction operations.

END OF SECTION

SECTION 09 8430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing panels.

B. Sound-absorbing ceiling baffles.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.03 SUBMITTALS

A. See Section 01 3000 - 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, fabric orientation, and wood grain orientation.

D. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

1.05 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 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Manufacturers:

1. Conwed Designscape/Wall Technology: www.conweddesignscape.com.
2. Egan Visual Corporation: www.egan.com.
3. Essi Acoustical Products Company: www.essiacoustical.com.
4. G&S Acoustics: www.gsacoustics.com.
5. Rockfon; Baffles: www.rockfon.com.
6. TECHLITE: www.techlite.com.
7. Substitutions: See Section 01 6000 - 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. Fabric-Covered Acoustical Panels for Walls (SAWP-#):

1. Panel Core: As indicated on the drawings.
2. Panel Thickness: As indicated on the drawings.

3. Edges: As indicated on the drawings.
4. Corners: As indicated on the drawings.
5. Fabric: As indicated on the drawings.
6. Color: As indicated on the drawings.
7. Mounting Method: Back-mounted with mechanical fasteners.

D. Fabric-Covered Acoustical Ceiling Baffles (SACP-#):
1. Basis of Design: As indicated on drawings.
2. Baffle Core: Manufacturer's standard rigid or semi-rigid fiberglass core.

E. Sound Diffusers (DIFF-#):
1. Basis of Design: As indicated on drawings.

2.02 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.03 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.

B. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.

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. Suspend ceiling baffles at locations and heights as indicated.

E. 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 CLEANING

A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 9113 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished unless noted otherwise including, but not limited to, the following.

1. Exposed surfaces of steel lintels and ledge angles.
2. Mechanical and Electrical:
    a. Exterior mechanical and electrical: Paint all mechanical and electrical pipes, conduits, etc that penetrate exterior building walls, except as indicated below in paragraph D.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
6. Marble, granite, slate, and other natural stones.
7. Floors, unless specifically indicated.
8. Glass.
9. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9123 - Interior Painting.

C. Divisions 21 through 26: Identification for mechanical and electrical systems.

1.03 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

D. SSPC-SP 2 - Hand Tool Cleaning; 2024.

E. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

F. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
   3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color, sheen, type, sheen, surface texture, sheen, and sheen; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Benjamin Moore & Co: www.benjaminmoore.com.
2. Diamond Vogel Paints: www.diamondvogel.com.
3. PPG Paints: www.ppgpaints.com.
4. Pratt & Lambert Paints: www.prattandlambert.com.
5. Sherwin-Williams Company: www.sherwin-williams.com.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.

1. Selection to be made by Architect after award of contract.
2. Allow for minimum of six colors for each system, unless otherwise indicated, without additional cost to St. Cloud School District 742.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, primed wood, and primed metal.

1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
3. Primer: As recommended by top coat manufacturer for specific substrate.
4. Masonry: One coat of block filler as recommended by top coat manufacturer for specific substrate.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.

G. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

H. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

J. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9123 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Elevator pit ladders.
3. Prime surfaces to receive wall coverings.
4. Mechanical and Electrical:
    a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    b. In finished areas, paint shop-primed items.
    c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
6. Marble, granite, slate, and other natural stones.
7. Floors, unless specifically indicated.
8. Ceramic and other tiles.
9. Glass.
10. Concrete masonry units in utility, mechanical, and electrical spaces.
11. Acoustical materials, unless specifically indicated.
12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

C. Divisions 21 through 26: Identification for mechanical and electrical systems.

1.03 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
D. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system products to be used in project; include description of each system.
C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
   3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
E. Manufacturer's Instructions: Indicate special surface preparation procedures.
F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
G. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gal (4 L) of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Primer Sealers: Same manufacturer as top coats.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: See Section 01 6116.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors (PT-#): As indicated on drawings.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, and galvanized steel.

1. Two top coats and one coat primer.
2. Top Coat(s): Interior Latex.
   a. Basis of Design Products:
      1) Benjamin Moore Ultra Spec 500.
      2) Sherwin-Williams ProMar 200 Zero VOC.

3. Top Coat Sheen:
    a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    b. Eggshell: MPI gloss level 3; use this sheen at walls.
    c. Satin: MPI gloss level 4; use this sheen at walls.
4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades, all exposed precast walls or interior faces, walls in classrooms, concrete columns, CMU.
2. Two top coats and one coat primer.
3. Top Coat(s): High Performance Architectural Interior.
    a. Basis of Design Products:
        1) Walls: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
        2) All other Components: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
4. Top Coat(s): Video and photography situation backgrounds
5. Primer: As recommended by top coat manufacturer for specific substrate.

C. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping, precast tees, hollow core planks.
1. Shop primer by others.
2. One top coat.
3. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
    a. Basis of Design Products:
        1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #155, 226)
4. Primer: As recommended by top coat manufacturer for specific substrate.

D. Paint I-OP-C - Film Studio:
1. Basis of Design: Pro Cyc; Cyclorama White Studio Paint: www.ProCyc.com.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

H. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

I. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

J. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9600 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

A. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 2 - Hand Tool Cleaning; 2024.

F. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

G. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.

C. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

F. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.

1. Extra Coating Materials: 1 gallon (4 liters) of each type and color.
2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

F. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

B. Waterbourne Acrylic Enamel (HPC-2):
   1. Number of coats: Two.
   2. Wet Film Thickness: 4.0 mils.
   3. Wet Microns: 102.
   4. Dry Film Thickness: 1.5 mils.
   5. Dry Microns: 38.
   6. Basis of Design.
      a. PPG; Break-Through! Low VOC: www.ppgpaints.com.

C. Epoxy Coating (HPC-1#):
   1. Number of coats: Two.
   2. Top Coat(s): Polyamide Epoxy; MPI #77, #177.
      a. Color: As selected by Architect.
      b. Sheen: Gloss.
      c. Basis of Design Products:

1) PPG Protective and Marine Coatings; Amerlock 400 High Solids Epoxy Coating, AK-400 Series, Semi-Gloss: www.ppgpmc.com/#sle.
2) PPG Protective and Marine Coatings; Amerlock 600 Epoxy, AK-600 Series, Semi-Gloss: www.ppgpmc.com/#sle.
3) Sherwin-Williams; Macropoxy 646-100 Epoxy, B58-600 Series: www.protective.sherwin-williams.com/#sle.
4) Sherwin-Williams; Macropoxy 646 Fast Cure Epoxy: www.protective.sherwin-williams.com. (MPI #177)

3. Top Coat(s): Epoxy-Modified Latex; MPI #115, #215.
4. Primer: As recommended by coating manufacturer for specific substrate.

D. Acrylic Insulation Coating (THERMBRK-2):
1. Number of Coats: Two.
2. Product Characteristics:
3. Intermediate Coat(s): Acrylic insulation coating, one-component.
a. Sheen: Flat.
b. Products:
1) PPG Paints; Hi-Temp 808: www.ppgpaints.com.
2) Tnemec Company, Inc; Series 971 Aerolon: www.tnemec.com.
3) Substitutions: Section 01 6000 - Product Requirements.
4. Primer: As recommended by coating manufacturer for specific substrate.

E. Masonry Filler: Vehicle and resin compatible with topcoats, formulated for applied thickness of 10-20 mils (0.25-0.50 mm); Basis of Design: Kem Cati-Coat HS Epoxy Filler/Sealer manufactured by Sherwin Williams.

2.02 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Do not begin application of coatings until substrates have been properly prepared.
C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
E. Masonry: Verify masonry joints are struck flush.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.
B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
C. Remove finish hardware, fixture covers, and accessories and store.
D. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean concrete according to ASTM D4258. Allow to dry.
3. Prepare surface as recommended by coating manufacturer and in accordance with SSPC-SP 13/NACE No.6.

E. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by coating manufacturer.

F. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

G. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3, and protect from corrosion until coated.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 10 mils (0.250 mm).

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 09 9723 - CONCRETE AND MASONRY COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Moisture resistant textured concrete and masonry coatings.

B. Moisture resistant smooth concrete and masonry coatings.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2026.

B. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings; 2017.

C. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints; 2025.

D. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2025.

E. ASTM D1653 - Standard Test Methods for Water Vapor Transmission of Organic Coating Films; 2013 (Reapproved 2021).

F. ASTM D2243 - Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings; 2020.

G. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity; 2025.

H. ASTM D2370 - Standard Test Method for Tensile Properties of Organic Coatings; 2016 (Reapproved 2021).

I. ASTM D4803 - Standard Test Method for Predicting Heat Buildup in PVC Building Products; 2024.

J. ASTM D6904 - Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry; 2003 (Reapproved 2022).

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

M. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

N. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials; 2025.

O. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

P. SSPC-SP 2 - Hand Tool Cleaning; 2024.

Q. SSPC-SP 3 - Power Tool Cleaning; 2024.

R. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

S. SSPC-SP 7/NACE No.4 - Brush-Off Blast Cleaning; 2006.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.06 MOCK-UP

A. Provide mock-up of 12 foot 4 inches tall by 8 foot wide, illustrating coating, color, and surface sheen, for each specified coating.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 CONCRETE AND MASONRY COATINGS

A. Provide high-build, weather resistant coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:

1. Salt Spray Resistance: Passes when tested according to ASTM B117 for 2000 hours.
2. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
3. Accelerated Outdoor Exposure: Passes when tested according to ASTM G153 for 5,000 hours.

2.02 MATERIALS

A. Coatings - General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated.

1. Maximum volatile organic compound (VOC) content: As required by applicable regulations.

B. Semi-transparent Finish (CONC ST-1): Silicate based mineral stain solution that forms a chemical bond with substrate:

1. Basis of Design: NawTone-K manufactured by Nawkaw: www.NawKaw.com.
2. Viscosity: 72 degrees F.
3. Finish: Flat.
4. VOC: ASTM D6886; 0 g/L.
5. Water Vaporance Permeance: 4.5x10-6 g/Pa s m2.

6. Water Diffusion Resistance: sd(H20)<0.01 m.
7. Color: As selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
C. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent.
D. Masonry: Verify masonry joints are struck flush.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.
B. Remove substances that would bleed through finished coatings.
C. Remove finish hardware, fixture covers, and accessories and store.
D. Existing Painted and Sealed Surfaces:
   1. Strip existing paint and coatings from surface.
   2. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.
   3. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.
E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.
F. Ferrous Metal:
   1. Solvent clean.
   2. Remove loose rust, loose mill scale, and other foreign substances using hand tools in accordance with SSPC-SP 2, power tools in accordance with SSPC-SP 3, or blast cleaning in accordance with SSPC-SP 6/NACE No.3 and SSPC-SP 7/NACE No.4.
G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
B. Concrete and Masonry: Prior to priming, patch holes and indentations and fill cracks with manufacturer's recommended crack repair material.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.
B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 10 1100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

B. Tackboards.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on chalkboard, porcelain enamel steel markerboard, glass markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Samples: Submit two samples 2 by 2 inch (50 by 50 mm) in size illustrating materials and finish, color and texture of markerboard, tackboard, and trim.

E. Manufacturer's printed installation instructions.

F. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 VISUAL DISPLAY UNITS

A. Markerboards (MRKBD-#): Porcelain enamel on steel, laminated to core.

1. Color: As selected from manufacturer's full range.
2. Size: As indicated on drawings.
3. Frame: Extruded aluminum , with concealed fasteners.
4. Frame Finish: Anodized, natural.
5. Accessories: As indicated on drawings.

B. Tackboards (TKBD-#): Composition cork.

1. Cork Thickness: 1/4 inch (6 mm).
2. Color: As indicated on drawings.
3. Backing: Hardboard, 1/4 inch (6 mm) thick, laminated to tack surface.
4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

5. Size: As indicated on drawings.
6. Frame: Same type and finish as for markerboard.

2.02 MATERIALS

A. Adhesives: Type used by manufacturer.

2.03 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. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.
C. Magnets: 1.25 inches diameter or square, color: white.
D. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.
B. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.
B. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 1200 - DISPLAY CASES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface-mounted display cases.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit complete printed data and installation details indicating products to be provided as specified.

C. Shop Drawings: Submit complete installation details. Include dimensioned elevations.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver display cases and materials to the Project site with manufacturer’s protective crate covering and do not open until ready for use.

B. Protect display cases before, during, and after installation. In case of damage, immediately provide necessary repairs and replacements.

1.06 FIELD CONDITIONS

A. Field Measurements: Verify field measurements for recessed application for display cases before preparation of shop drawings and before fabrication to ensure proper installation.

1.07 WARRANTY

A. See Section 01 7800 - 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 DISPLAY CASES (DISPLAY CASE-#)

A. Recessed Display Case: Factory-fabricated aluminum-framed display case with adjustable glass shelves, finished interior.

1. Basis of Design: As indicated on drawings.

B. Free-standing Display Case: Factory-fabricated aluminum framed display case with adjustable glass shelves, finished interior.

1. Basis of Design: As indicated on drawings.

2.02 MATERIALS

A. Aluminum Extrusions for Framing and Trim: Alloy as recommended by manufacturer for construction and specified finish; nominal 1/8 inch (3.2 mm) wall thickness.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper.

1. Finish: Factory anodized; AAMA 611: Clear anodized.

C. Plywood: Softwood plywood with veneer core, waterproof glue, 3/4 inch (19 mm) thick.

D. Heat-Strengthened and Fully Tempered Glass: ASTM C1048, Kind FT.

PART 3 EXECUTION

3.01 PREPARATION

A. Rough openings, electrical pre-wiring, and final finishing are by other trades.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING AND CLEANING

A. Verify that all accessories are installed as detailed for each unit.

B. At completion of work, clean glass surfaces, back panels and trim in accordance with manufacturer’s recommendations leaving units ready for use.

END OF SECTION

SECTION 10 1416 - PLAQUES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plaques.

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 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of plaque sign, indicating style, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings: Indicate dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package plaque signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.01 PLAQUES

A. Metal Plaques:

1. Material: Bronze casting.
2. Basis of Design: As indicated on drawings.

2.02 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

B. Exposed Screws: Solid brass.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

END OF SECTION

SECTION 10 1419 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimensional letter signage.

B. Illumination system.

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 - 2010 ADA Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

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

E. UL 879 - Electric Sign Components; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
2. Show locations of electrical service connections.
3. Include diagrams for power, signal, and control wiring.

D. Verification Samples: Submit samples showing colors and finishes specified.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package dimensional letter signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dimensional Letter Signs:

1. Gemini: www.geminimade.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DIMENSIONAL LETTERS

A. Applications: Building identification.

1. Use individual metal letters.
2. Mounting Location: Exterior as indicated on drawings.

B. Metal Letters:

1. Material: As indicated on drawings.
2. Thickness: As indicated on drawings.

3. Letter Height: As indicated on drawings.
4. Text and Typeface: As indicated on drawings.
5. Finish: As indicated on drawings.
6. Color: As indicated on drawings.
7. Mounting: Concealed screws.
8. Illumination System: Halo-lit reverse channel letters.
    a. Provide products that are listed and labeled as complying with UL 879, where applicable.
    b. Power: 120 V, 60 Hz, 1 phase, 15 A.

C. Plastic Letters:
1. Material: Vinyl sheet, flat cutout.
2. Thickness: Manufacturer's standard for letter size.
3. Letter Height: As indicated on drawings.
4. Text and Typeface:
    a. Character Font: Helvetica, Arial, or other sans serif font.
5. Finish: Semi-gloss.
6. Color: As selected.
7. Mounting: Concealed or exposed screws.

2.03 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.
B. Exposed Screws: Stainless steel.
C. Electrical Components and Devices: Listed and labeled as defined in NFPA 70 by a qualified testing agency.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
B. Verify that electrical service is correctly sized and located to accommodate dimensional letter signs.
C. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install with horizontal edges level.

END OF SECTION

SECTION 10 1423 - PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage.

B. Illumination system.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

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

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
2. Show locations of electrical service connections.
3. Include diagrams for power, signal, and control wiring.
4. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
    a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
    b. When content of signs is indicated to be determined later, request such information from St. Cloud School District 742 through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
    c. Submit for approval by St. Cloud School District 742 through Architect prior to fabrication.

D. Verification Samples: Submit samples showing colors, materials, and finishes specified.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

C. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panel Signage:
   1. Best Sign Systems, Inc: www.bestsigns.com.
   2. Inpro Corporation: www.inprocorp.com.
   3. Mohawk Sign Systems, Inc: www.mohawksign.com.
   4. Seton Identification Products: www.seton.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.03 PANEL SIGNAGE

A. Panel Signage:
   1. Application: Room and door signs.
   2. Description: Flat signs with engraved panel media, tactile characters.
   3. Sign Size: As indicated on drawings.
   4. Total Thickness: 1/8 inch (3 mm).
   5. Color and Font: As indicated on drawings.
   6. Material: As indicated on drawings.
   7. Profile: As indicated on drawings.
      a. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, non glare on front.
   8. Tactile Letters: As indicated on drawings.
   9. Braille: Grade II, ADA-compliant.
   10. One-Sided Wall Mounting: Tape adhesive.
   11. Illumination System: Reverse cut out panel.
      a. Power: 120 V, 60 Hz, 1 phase, 15 A.

2.04 SIGNAGE APPLICATIONS - AS INDICATED ON DRAWINGS

2.05 ACCESSORIES

A. Tape Adhesive: Double-sided tape, permanent adhesive.
B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70 by a qualified testing agency.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
B. Verify that power and data service is correctly sized and located to accommodate panel signs.
C. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

END OF SECTION

SECTION 10 14 53 - TRAFFIC SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. This work shall consist of furnishing and installing traffic and parking signage in pavement surfaces, in the form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other signage, in accordance with the details and finishing plan, or as prescribed by the Owner.

1.2 SUBMITTALS

A. In accordance with SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish Manufacturer's Certificates and Data certifying that the following materials conform to the requirements specified.

PART 2 PRODUCTS

2.1 SIGNS

A. Signs shall meet the requirements of MnDOT Standard Specifications for Construction, 2020 Edition, Section 3352, the most current MnDOT special provisions, and the MN MUTCD.

2.2 SIGN POSTS

A. Sign posts shall meet the requirements of MnDOT Standard Specifications for Construction, 2020 Edition, Section 3401, 3402, and the most current MnDOT special provisions.

PART 3 EXECUTION

3.1 GENERAL

A. Execution shall be in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2564, the most current MnDOT special provisions, and the MN MUTCD and as shown in the plans except as modified herein.

3.2 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify location of all undergrounding utilities prior to commencing the work.

3.3 INSTALLATION

A. Locations of signs on the Plans are approximate. Final locations of the signs shall be approved the Engineer or Owner's Representative prior to installation.

B. Posts shall be installed plumb and to the requirements set forth in MnDOT specifications and the plans. Posts that are bent or otherwise damaged shall be removed and replaced at no expense to the Owner.

C. Set posts as shown in the details for signs installed in asphalt, concrete or other pavement surfaces.

D. Prior to completion, remove all rust and clean post and signs of all grease, oil or other contaminating materials.

3.4 PROTECTION

A. Conduct installation operations in such a manner that necessary traffic can move without hindrance.

B. Protect the signs from damage from continuing construction and traffic. Replace damaged signs at no additional cost to the Owner.

3.5 FINAL CLEAN-UP

A. Remove all debris, rubbish and excess material from the Site.

END OF SECTION

SECTION 10 2113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - 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 x 6 inch (152 x 152 mm) in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:

1. All American Metal Corp - AAMCO: www.allamericanmetal.com.
2. Metpar Corp: www.metpar.com.
3. Sanymetal Products Company: www.sanymetal.com.
4. Scranton Products: www.scrantonproducts.com.
5. Substitutions: Section 01 6000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments (COMP-1): Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), Class A, tested in accordance with NFPA 286; floor-mounted unbraced.

1. Color: As indicated on drawings.

B. Doors:

1. Thickness: 1 inch (25 mm).
2. Width: 24 inch (610 mm).
3. Width for Accessible: 36 inch (915 mm), out-swinging.
4. Width for Ambulatory: 34 inches (864 mm), out-swinging.
5. Height: 55 inch (1397 mm).

C. Panels:

1. Thickness: 1 inch (25 mm).

2. Height: 55 inch (1397 mm).
3. Depth: As indicated on drawings.

D. Pilasters:
1. Thickness: 1 inch (25 mm).
2. Width: As required to fit space; minimum 3 inch (76 mm).

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.
1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Extruded aluminum, anti-grip profile.
1. Size: Manufacturer's standard size.

C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

E. Hinges: Stainless steel, manufacturer's standard finish.
1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.

F. Door Hardware: Stainless steel, manufacturer's standard finish.
1. Door Latch: Slide type with exterior emergency access feature.
2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.

G. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 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.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 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 2123 - CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended overhead curtain track and guides.

B. Surface mounted overhead curtain track and guides.

C. Cubicle curtains.

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings: Suspended ceiling system to support track.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for curtain fabric characteristics.

C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.

D. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Carriers: Ten.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cubicle Track:

1. A. R. Nelson Co: www.arnelson.com.
2. Construction Specialties, Inc: www.c-sgroup.com.
3. Imperial Fastener Co., Inc: www.imperialfastener.com.
4. Inpro: www.inprocorp.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRACKS AND TRACK COMPONENTS

A. Tracks (CUBICLE-1): Extruded aluminum sections; one piece per track run.

1. Profile: Channel.
2. Mounting: ACT Ceiling Grid.
3. Structural Performance: Capable of supporting vertical test load of 50 lbs (23 kg) without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
4. Track End Stop: To fit track section.
5. Track Bends: Minimum 12 inch (300 mm) radius; fabricated without deformation of track section or impeding movement of carriers.
6. Suspension Rods: Tubular aluminum sections, sized to support design loads and designed to receive attachment from track and ceiling support.
7. Escutcheons: Where suspension rod meets finished ceiling or structure, provide escutcheons to match rod finish.
8. Finish on Exposed Surfaces: White enamel.

B. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.

C. Wand: Plastic, attached to lead carrier, for pull-to-close action.

D. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.03 CURTAINS

A. (CURTAIN-#): As indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install curtain track to be secure, rigid, and true to ceiling line.

B. Suspend track from ceiling system.

C. Install curtains on carriers ensuring smooth operation.

END OF SECTION

SECTION 10 2130 - PVC STRIP CURTAINS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended overhead pvc strip curtain and bracket.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: St. Cloud School District 742-installed curtains.

B. Section 06 1000 - Rough Carpentry: Blocking and supports for track.

1.03 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for curtain fabric characteristics.

C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Maintenance Data: Include recommended cleaning methods and materials.

1.05 WARRANTY

A. Manufacturer's standard 5 year warranty on materials and workmanship.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept curtain materials on site and inspect for damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Welding Curtains:

1. AmCraft Manufacturing, Inc: www.amcraftindustrialcurtainwall.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 UNIVERSAL STRIP DOOR BRACKETS

A. Suspended Brackets: Resistant to hydrochloric acid and chlorine.

2.03 PVC STRIP DOOR

A. Strip Door Materials:

1. Naturally flame resistant or flameproofed; capable of passing NFPA 701 test.
2. Manufacturer's standard mounting hardware and supports.
3. Color: As selected by architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work of this Section.

3.02 INSTALLATION

A. Install curtain track to be secure, rigid, and true to ceiling line.

B. Install curtains on carriers ensuring smooth operation.

END OF SECTION

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010, with Editorial Revision (2015).

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1. Submit two sections of corner guards, 6 inches (152 mm) long.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in St. Cloud School District 742's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for St. Cloud School District 742's use in maintenance of project:

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Stock Materials: One package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for corner guards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in St. Cloud School District 742's name and register with manufacturer.

1. Failures include, but are not limited to, the following:
    a. Structural failures or internal connection failures.
    b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:
    1. Construction Specialties, Inc: www.c-sgroup.com.
    2. Inpro: www.inprocorp.com.
    3. Koroseal Interior Products: www.koroseal.com.
    4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted (CG-#):
    1. Material: High impact vinyl with full height extruded aluminum retainer; surface mount.
    2. Performance: Impact strength of 30.2 ft-lbs/inch of thickness; as tested in accordance with ASTM D-256-90b.
    3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
    4. Width of Wings: As indicated on drawings.
    5. Corner: As indicated on drawin
    6. Color: As indicated on drawings.
    7. Length: As indicated on drawings.
B. Adhesives and Primers: As recommended by manufacturer.
C. See Section 06 1000 for wood blocking for wall and corner guard anchors.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
B. Verify that field measurements are as indicated on drawings.
C. Verify that substrate surfaces for adhered items are clean and smooth.
D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches (102 mm) above finished floor to ceiling.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.04 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.
B. Commercial shower and bath accessories.
C. Diaper changing stations.
D. Adult changing stations.
E. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
E. ASTM C1036 - Standard Specification for Flat Glass; 2016.
F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - 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, Shower, and Bath Accessories:
    1. American Specialties, Inc: www.americanspecialties.com.
    2. Bradley Corporation: www.bradleycorp.com.
    3. Bobrick Washroom Equipment Inc: www.bobrick.com.
    4. Substitutions: Section 01 6000 - Product Requirements.
B. Provide products of each category type by single manufacturer.

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.
    1. Grind welded joints smooth.
    2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Framed Mirrors: Stainless steel framed, 6 mm thick tempered glass mirror.
   1. Basis of Design: 780 Series manufactured by Bradley.
   2. Size:
      a. (MIR-10): 24 inches x 36 inches.
      b. (MIR-11): 18 inches x 36 inches.
      c. (MIR-12): 24 inches x 60 inches.
   3. Basis of Design: 7815 Series manufactured by Bradley.
   4. Size:
      a. (MIR-13): 18 inches x 36 inches.
   5. Frame: 0.05 inch (1.3 mm)angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.

B. Frameless Mirrors (MIR-50): Frameless, 6 mm thick mirror.
   1. Size: As indicated on drawings.
   2. Installation: Secure mirror with metal mounting clips to wall with screws, then engage mirror into clips.
   3. Basis of Design: 747 Series manufactured by Bradley.

C. Grab Bars: Stainless steel, textured 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.
      d. Length and Configuration (see drawings for which of the following are used):
         1) (GB-18): 18 inches. Basis of Design 812 Series by Bradley.
         2) (GB-36): 36 inches. Basis of Design 812 Series by Bradley.
         3) (GB-42): 42 inches. Basis of Design 812 Series by Bradley.
         4) (GB-L): L-Shaped. Basis of Design 800 Series by Bradley.

D. Sanitary Napkin Disposal Unit (ND-1): Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Basis of Design: Model 4722-15 manufactured by Bradley.

E. Coat Hook (HK-1): Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.
   1. Basis of Design: Model 9134 manufactured by Bradley.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod (ROD-#): Stainless steel tube, 1 inch (25 mm) outside diameter, 0.04 inch (1.0 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.
   1. Basis of Design: Model 9539 manufactured by Bradley.
   2. Length:
      a. (ROD-1): 36 inches.
      b. (ROD-2): 60 inches.

B. Shower Curtain (SCT-#):
   1. Material: Opaque vinyl, 0.008 inch (0.2 mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
   2. Size: (SCT-1) 36 by 72 inches; (SCT-2) 60 by 72 inches; hemmed edges.
   3. Grommets: Stainless steel; pierced through top hem on 6 inch (150 mm) centers.
   4. Color: As selected from manufacturer's standard colors.
   5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.

C. Folding Shower Seat: (SST-1) Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
   1. Basis of Design: Model 9569 manufactured by Bradley.
   2. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
   3. Size: ADA Standards compliant.

2.06 CHANGING STATIONS

A. Adult Changing Station (ACS-1): Wall-mounted, folding diaper changing station for use in commercial toilet facilities, height adjustable.
   1. Basis of Design: Model 100SSE-SM Special Needs Stainless Steel Diaper Changing Station manufactured by Foundations Worldwide, Inc.
   2. Material: Stainless steel.
   3. Mounting: Surface.
   4. Minimum Rated Load: 500 lb (226.8 kg).

2.07 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder (MOP-1): 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. Basis of Design: Model 9933 manufactured by Bradley.
   2. Hooks: Two, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
   3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
   4. Length: Manufacturer's standard length for number of holders/hooks.
   5. Provide one in each janitor's closet, locations indicated as (MOP-1), unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06 1000 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

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.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 4400 - 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 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, and rough-in measurements for recessed cabinets.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:

1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
2. Ansul, a Tyco Business: www.ansul.com.
3. Kidde, a unit of United Technologies Corp: www.kidde.com.
4. Pyro-Chem, a Tyco Business: www.pyrochem.com.
5. Substitutions: See Section 01 6000 - Product Requirements.
6. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
7. Larsen's Manufacturing Co: www.larsensmfg.com.
8. Substitutions: See Section 01 6000 - 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. Provide one fire extinguisher for each cabinet or bracket indicated on the drawings.
   2. Basis of Design: Cosmic by JL Industries.
   3. Class: A:B:C type.
   4. Size: 10 pound (4.54 kg).
   5. Finish: Baked polyester powder coat color as selected.
   6. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Fire-Rated Construction: Provide fire-rated cabinets in fire-rated walls (see drawings for locations).
B. Cabinet Configuration (FCAB-1): Semi-recessed type.
   1. Size to accommodate accessories.
   2. Basis of Design: JL Industries "Ambassador Series" sized for 10 lb fire extinguisher.
   3. Projected Trim: Returned to wall surface, with 2-1/2 inch (63 mm) projection, and 1-3/4 inch (44 mm) wide face.
   4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
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 two butt hinges.
D. Door Glazing: Float glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.
E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
F. Fabrication: Weld, fill, and grind components smooth.
G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets (FBRKT-1): Formed steel, chrome-plated.
B. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).
C. Fire Department Access Box (FIRE BOX-1):
   1. Acceptable manufacturers, subject to compliance with specified requirements:
      a. Dama, S3 (surface-mount)
      b. Dama, R3
      c. Knox-Box, 3200 Series
      d. Tru-Lock, Eau Claire, WI
   2. Verify manufacturer is acceptable to local Fire Department.
   3. Requirements:
      a. Coordinate keying requirements with the authority having jurisdiction.
      b. Verify surface or flush mount box with Architect.
      c. Finish: Corrosion resistant.
   4. Locations: As indicated on drawings.

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. Secure rigidly in place.

C. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 5617 - WALL MOUNTED STANDARDS AND SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel shelf standards, brackets, and accessories.

B. Shelves.

C. See drawings for locations and configurations.

1.02 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products under cover and elevated above grade.

B. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Shelf Standards and Brackets:

1. Knape & Vogt Manufacturing Company: www.knapeandvogt.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Steel Shelf Standards, Brackets, and Accessories:

1. Extra-Duty Shelf Standards and Brackets: Double-slotted channel standards for brackets adjustable in 1 inch (25 mm) increments along entire length of standard, drilled and countersunk for screws.
    a. Basis of Design Product: KV 85/187.
    b. Load Capacity: Recommended by manufacturer for loading of 300 to 680 pounds (135 to 310 kg) per pair of standards.
    c. Finish: Electroplated, chrome-look.
    d. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
    e. Bracket Quantity: Provide one bracket for each 12 inches (305 mm) of standard length.

B. Shelving:

1. Laminate Faced Shelves: Particleboard or medium density fiberboard covered with high pressure decorative laminate on both sides.
    a. Edge Finish: Matching laminate, all four edges.
    b. Substrate Thickness: 3/4 inch (19 mm), nominal.
    c. Laminate: NEMA LD 3 Type HGL.

C. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions. Finish of exposed to view fasteners to match finish of standards and other components.

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 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. Mount standards or brackets to solid backing capable of supporting intended loads.

C. Install brackets, shelving, and accessories.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 75 00 - FLAGPOLE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Ground Sleeve cone tapered aluminum flagpoles with internal halyard system, combination LED light/track assembly, remote power supply, pulleys, fittings and accessories as required for complete finished installation.

B. Provide all electrical components for exterior flagpole lighting.
   1. Electrical contractor shall install components and make all connections.

1.2 REFERENCES

A. American National Standards Institute (ANSI)

B. National Association of Architectural Metal Manufacturers (NAAMM)

C. Metal Flag Pole Manual (FP 1001-07)

D. International Darksky Association (IDA)

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Design pole and anchorage system to resist, without permanent deformation, and non-resonant, largest flag intended to be flown in the highest windspeed to which it will be subjected. LED light/truck assembly compatible with flagpole.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer detail specifications.

B. Shop Drawings: Indicate dimensions of pole, anchor requirements, all components and sizes, LED light/truck details, 3 Year Warranty.

C. Samples: Submit pole finish or color.

1.5 DELIVERY, STORAGE AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in shipping tubes. Wrapping must be removed at the time of arrival to site. Poles should not be stored outside with wrapping material.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Eagle Mountain Flag and Flagpoles – StarGazer.

B. OR EQUAL.

2.2 MATERIALS

A. Flagpole: One piece, cone tapered aluminum flagpole; conforming to American National Standards Institute (ANSI), National Association of Architectural Metal Manufacturers (NAAMM): Metal Flag Pole Manual (FP 1001-07).
   1. Type: Ground Sleeve Mount.
   2. Nominal Height: 30FT.

3. Butt Diameter: To be determined based on pole height and maximum intended flag size for subjected wind load rating.
4. Wall Thickness: To be determined based on pole height and maximum intended flag size for subjected wind load rating.
5. Positive lightning protection constructed of 7-strand, 1/2? diameter x 6' long aluminum cable and 5/8” diameter x 5' long copper clad rod.

B. Aluminum ASTM B221
   1. Finish: Manufacture’s standard satin aluminum.

C. Flash Collar – Spun aluminum 1piece.

D. Ground Sleeve: Direct Burial: Ground Sleeves – Galvanized Corrugated Steel with Steel Lightning Spike,Two-Piece Design
   1. Corrugated Steel Ground Sleeves with Steel Lightning Spike are designed for use in Ground Set flagpole installations. 2-piece design contains an upper section manufactured of galvanized 16-gauge corrugated steel tube, a 3/16”-1/2” thick steel base plate, and steel centering wedges welded into the base to assist in plumb installations of the flagpole. The lower section incorporates a threaded top 3/4? diameter steel grounding spike with 6? x 6? steel setting plate, allowing the concrete foundation to completely surround the sleeve.

E. Internal Halyard Rope Based System: with cam cleat and locking flush access door.
   1. Provide snap hooks.
   2. Provide rubber covered counterweight
   3. Provide retainer ring.

F. Flag – Provided by Owner.

G. LED light/truck assembly – StarGazer LED light/truck furnished as fully assembled unit, 3000 kelvin or as required by local ordinance. Full cutoff optics with International Darksky Association (IDA) certification. Product must have BUG rating B0-U0-G0. 24 Vdc input to light source, max distance of light source to StarGazer remote power supply is 150 feet.

H. Pre-wire internal components to terminal strips at the factory.

I. Provide manufacturers’ standard finish, as scheduled on the drawings. Where indicated on the drawings, match finish process and color of pole or support materials.

J. LED source shall meet the following requirements:
   1. Shall be certified, listed and warranted by the manufacturer for operating temperature rating between -40 degrees C (-40 degrees F) and 50 degrees C (122 degrees F)
   2. Correlated Color Temperature (CCT): as indicated on the LIGHTING FIXTURE SCHEDULE
   3. Color Rendering Index (CRI): ?90

K. StarGazer remote power supply direct burial (DDLIGDRIVER) and meet the following requirements;
   1. LISTED TO UL STANDARD 2108
   2. MANDATORY SECONDARY PROTECTION, AS STATED IN THE NATIONAL ELECTRIC CODE ARTICLE 411, (1993, 1996, 1999, 2002, 2005 AND 2008)
   3. INPUT VOLTGE RANGE FROM 120-277VAC, 24 VDC, 50/60Hz, 40 watts maximum
   4. NEMA 12 PVC NON-METALLIC BOX WITH BRASS SCREW INSERTS (For DDLIGDRIVER only)
   5. SHORT CIRCUIT / OVER VOLTAGE / OVER TEMPERATURE PROTECTION

6. STANDARD WITH WATER TIGHT 3/4” FITTING FOR PRIMARY VOLTAGE (For DDLIGDRIVER only)
7. STANDARD WTIH 3 CUSTOM BRASS FITTINGS FOR LOW VOLTAGE CONNECTION (For DDLIGDRIVER only)
8. MEETS OR EXCEEDS ALL UL, CUL, ANSI/UL, CSA REQUIREMENTS
9. 3 Year Warranty

PART 3 EXECUTION

3.1 PREPARATION

A. Install ground sleeve and complete foundation for flagpoles correctly sized and positioned according to manufacturer’s recommendations and the drawing details**.**

3.2 INSTALLATION

A. Install flagpole, lightning protection, and fittings in accordance with manufacturer’s recommendations and installation instructions and as indicated on drawings.
   1. LED light/truck low voltage cable assembly with remote power supply installed by electrical contractor.

B. Install owner specified flag.

C. Check and adjust installed fittings for a smooth operation.

D. Instruct Owner’s representative in maintenance and operation.

3.3 FIELD QUALITY CONTROL

A. Materials installed under this Section shall be subject to testing by the Owner at his expense. Materials tested and found to be not in strict conformance with this Section shall be promptly removed and replaced by the Contractor at the Contractor’s expense.

END OF SECTION

SECTION 10 8211 - ARCHITECTURAL COILED WIRE GRILLES AND SCREENS - CASCADE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural coiled wire grilles and screens.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Mounting substrates.

B. Section 06 1000 - Rough Carpentry: Mounting substrates.

1.03 DEFINITIONS

A. Coiled Wire Fabric: Building material created by interlocking strands of coiled wire to form a larger flexible sheet; coiled wire fabric is made from various metals and gauges of wire, and in a wide variety of sizes, weaves, finishes, and levels of fullness.

B. Attachment Systems: Components and materials required to provide coiled wire fabric in designated shape and form (i.e., flat under tension in two directions, under tension in two directions with a percentage of fullness, flat under tension in four directions, hanging in one direction, or wrapping a form, etc.). Attachment systems are used to connect coiled wire fabric to built environment and maintaining designated performance capability. Engineered attachments may allow coiled wire fabric systems to remain in fixed position or to move, either manually or mechanically.

1.04 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025.

C. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2024.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate field measurements and fabrication schedule with progress of construction to avoid construction delays.

B. Preinstallation Meetings: Conduct meetings including Contractor, Architect, fabricator, installer and other subcontractors whose work involves coiled wire fabric to confirm project requirements, framing and support conditions, mounting surfaces and manufacturer's installation requirements.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product used, including preparation instructions, storage and handling requirements, and installation methods.

C. Shop Drawings: Submit detailed shop drawings for fabrication and installation, including plans and elevations, detailed sections, materials, finishes, fittings, hardware, anchorages, fastening details, and manufacturer's technical and descriptive data.

D. Samples: Submit samples for color verification of each specified finish, at least 6 inch (254 mm) wide by 10 inch (254 mm) long.

E. Certificates: Submit certificates signed by manufacturers of coiled wire products certifying that products furnished comply with requirements.

F. Delegated Design Submittals: Submit comprehensive structural analysis of overall design for specified loads prepared by qualified professional engineer.

G. Designer's Qualification Statement.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in St. Cloud School District 742's name and registered with manufacturer.

1. Submit "Final Installation Contractor Checklist" to ensure warranty requirements have been met; see CCD website for copy of checklist.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Perform structural design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

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

1.08 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide mock-up of coiled wire fabric system for evaluation of desired appearance, performance, application and workmanship; size of mock-up not to exceed 50 sq ft (4.64 sq m).

1. Locate where directed by Architect.
2. Mock-up may remain as part of the Work.
3. Do not proceed with remaining work until mock-up is approved by Architect.
4. Retain mock-up during construction as quality standard.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packaging, with labels clearly identifying manufacturer and material.

B. Exercise care not to scratch, mark, dent, or bend metal components during delivery, storage, and installation.

C. Store materials indoors, protected from moisture, humidity, and extreme temperature fluctuations until ready for installation.

1.10 FIELD CONDITIONS

A. Verify dimensions of actual openings by field measurements before fabrication; provide recorded measurements on shop drawings.

1.11 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Coiled Wire Grilles and Screens Manufacturers:
   1. Cascade Coil Drapery, Inc, dba Cascade Architectural: www.cascade-architectural.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ARCHITECTURAL COILED WIRE GRILLES AND SCREENS SYSTEMS (MD-1)

A. Provide architectural coiled wire grilles and screens system with attachment method, materials, weaves, and finish as indicated; manufacturer and contractor to engineer and fabricate components and assemblies as required for installation in accordance with manufacturer's Custom Architectural System.
B. Attachment Method: Hook with Aluminum Angle.
C. Fabricoil Architectural Coiled Wire Fabric Weaves:
   1. Interior Application:
      a. Aluminum: 5/16 inch (8 mm) thick, 14 gauge wire.
D. Factory Finishes: Space Black; powder coatings tested in accordance with ASTM D3451.
E. Fullness: 25 percent.

2.03 PERFORMANCE REQUIREMENTS

A. Structural Requirements: Architectural coiled wire fabric systems capable of withstanding applied loads and stresses within designated limits and under conditions as indicated on drawings.
   1. Provide coiled wire fabric and attachment system components in accordance with applicable building code to withstand dead and live loads resulting from environmental conditions including, but not limited to, wind, seismic events, vegetation, rain, snow, and ice.
   2. Provide coiled wire fabric systems capable of accommodating expansion and contraction of metal components without causing undue stress, buckling, opening of joints, and distortion.
   3. Provide structural framing and hardware of coiled wire fabric systems capable of withstanding loads and maintain deflection limitations in accordance with applicable building codes when systems are fully installed.

2.04 COMPONENTS

A. Wire Attachment: Stainless steel, Type 304.
B. Angles: Aluminum.
C. Fasteners: Nuts, bolts, washers, and machine screws; stainless steel, Type 304.
D. Stainless Steel: Comply with ASTM A666/A666M.
E. Aluminum Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS) with AZ50/AZM150 coating; continuous coil-coated on exposed surfaces with specified finish coating, and manufacturer's standard panel back coating.

2.05 FABRICATION

A. Tolerances: Verify field dimensions prior to start of shop fabrication.
B. Fabricate steel and stainless steel components in accordance with manufacturer's requirements and the following:
   1. Comply with requirements indicated for metal materials, thickness, design, and details of construction; fabricate metal accurately and without any burrs.

2. Provide welded connections in compliance with American Welding Society (AWS) standards for recommended practice in shop welding.
3. Provide welds located behind finished surfaces that are without distortion or discoloration of exposed side.
4. Provide components that are accurately cut, drilled and/or tapped to receive coiled wire fabric, hardware, fasteners, and accessories.

C. Shop fabricate components in accordance with requirements indicated on drawings and specified performance requirements.

D. Shop fabricate hardware, interconnected parts, and assemblies to eliminate necessity for any field cutting adjustments.

E. Coordinate system requirements, dimensions and spacing of attachment components to ensure required factory drilled holes in supporting framework are properly located.

F. Provide exposed joints that are butt, flush, and hairline.

G. Fabricate exterior connections that will be exposed to weather in a manner that prevents water from entering interior portions of structure, in accordance with Architect.

2.06 ACCESSORIES

A. Fasteners: Comply with ASTM F593 for stainless steel or ASTM A307 for carbon steel, sizes to suit installation conditions.

B. Anchors and Inserts: Corrosion resistant; type, size, and material required for loading and installation as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to start of installation, verify that existing conditions are acceptable for installation of coiled wire fabric and attachment systems in accordance with manufacturer's installation instructions.

B. Coordinate with setting diagrams, plans, templates, and drawings to ensure that proper installation of necessary anchors and supporting devices has been completed.

C. Ensure that supporting system for coiled wire fabric has been properly prepared for attachment of framework, hardware, anchors, wire rope, and transfer of calculated loading.

D. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions prior to proceeding.

E. Coordinate with appropriate entity to correct any unsatisfactory conditions.

F. Start of this work indicates acceptance of areas and conditions as satisfactory by installer.

3.02 PREPARATION

A. Verify inventory of system components to ensure required components are available for installation; inspect components for damage, and replace damaged components as necessary.

B. Verify that alignment, support dimensions, and tolerances are correct.

C. Verify that necessary structural framing is installed prior to mounting coiled wire fabric attachment system components.

D. Verify that support framing and other surfaces to receive coiled wire fabric and attachment systems are clean and free of obstructions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Attach coiled wire fabric to structural framing using applicable hardware provided by manufacturer as indicated on approved shop drawings.

C. Provide necessary anchorage devices and fittings to securely fasten to on-site construction; including additional knife plates, embeds, framework, blocking, threaded rods, and anchors.

D. Provide for separation of dissimilar materials using bushings, grommets, or washers to prevent electrolytic corrosion.

E. Upon completion of final adjustments, provide tamper-resistant lock-tight material at mechanical fittings.

F. Provide for tension in coiled wire fabric as indicated on drawings, or as necessary to remove slack.

G. Coiled Wire Fabric Attachment System:

1. Install coiled wire fabric attachment system components in accordance with approved shop drawings.
2. Install attachment system assemblies based on manufacturer's dimensions.
3. Install joints that accommodate for expansion and contraction of metal components without causing undue stress, buckling, joint fatigue and/or distortion.
4. Install structural blocking at wall locations used for mounting of attachment system.
5. Install coiled fabric mounting hardware onto attachment systems as indicated on approved shop drawings for specified attachment system; attach with approved fasteners and techniques to ensure that framing members are horizontal and parallel to grade or slab, and straight to within 1/16 inch (1.6 mm) in 4 feet (1.2 m).
6. Install attachment system plumb, level, square, and rigid without having any kinks or sags in coiled wire fabric.

H. Coiled Wire Fabric:

1. Install coiled wire fabric in accordance with approved shop drawings.
2. Install coiled wire fabric based on manufacturer's dimensions.
3. Install joints that accommodate for expansion and contraction of metal components without causing undue stress, buckling, joint fatigue and/or distortion.
4. Install coiled wire fabric mounting hardware onto coiled wire fabric as indicated on approved shop drawings for specified attachment system; attach with approved fasteners and techniques to ensure that sections are horizontal and parallel to grade or slab, and straight to within 1/16 inch (1.6 mm) in 4 feet (1.2 m).
5. Install coiled wire fabric infill with attachment system plumb, level, square, and rigid without having any kinks or sags.

3.04 CLEANING

A. Remove temporary protective coverings of adjacent work areas, and clean installed materials prior to Date of Substantial Completion.

B. In heavy traffic areas, establish cleaning program to pressure wash or hand-wash coiled wire fabric and attachment system on a monthly basis prior to Date of Substantial Completion.

C. Clean coiled wire fabric system components with mild detergent and water applied with wet wrap and wiped with clean dry rag; abrasive cleaners are not permitted.

D. Remove from project site and legally dispose of construction debris associated with this work.

E. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.05 PROTECTION

A. Provide protection of installed coiled wire grilles and screens and finished surfaces to ensure they are without damage until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

C. Replace defective or damaged components as directed by Architect.

END OF SECTION

SECTION 11 4000 - FOODSERVICE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foodservice equipment.

B. Connections to utilities.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between equipment and adjacent walls, floors, and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

C. ASTM C1036 - Standard Specification for Flat Glass; 2025.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

E. FM (AG) - FM Approval Guide; Current Edition.

F. ITS (DIR) - Directory of Listed Products; current edition.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

H. NEMA MG 00001 - Motors and Generators; 2024.

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

J. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

K. NSF 2 - Food Equipment; 2022.

L. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

M. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility service connection locations, service characteristics, and wiring diagrams.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in St. Cloud School District 742's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of standard products of the type specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products clear of floor in a manner to prevent damage.

B. Coordinate size of access and route to place of installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work of this section within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for replacement or repair of scheduled equipment, refrigerant and compressors, including disconnection and removal of defective unit, and connection of replacement unit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foodservice Equipment:

1. Hobart Corp: www.hobartcorp.com/#sle.
2. Sani-Floor Trough Systems; Standard Floor Trough Systems: www.sanifloor.com/#sle.
3. Vulcan Hart Corp: www.vulcanhart.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for utility requirements.

B. Products Requiring Electrical Connection: Listed and classified by FM (AG), ITS (DIR), UL (DIR), or testing agency acceptable to local authorities having jurisdiction as suitable for the purpose specified and indicated.

2.03 EQUIPMENT

A. Equipment Schedule: Refer to schedule at end of this section.

1. Equipment Eligible for Energy Star Rating: Provide Energy Star Rated equipment
2. Cooler and Freezer Units: Listed by UL (DIR).
3. Electrical Wiring and Components and Self-Contained Refrigeration Systems: Comply with UL (DIR) listed product standards.
4. Exhaust Hoods: Comply with NFPA 96 and SMACNA (KVS).
5. Custom Fabricated Stainless Steel Equipment: See Section 11 4001.

B. Installation Accessories: Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories as required for complete installation.

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

B. Stainless Steel Sheet: ASTM A666/A666M Type 304 commercial grade, No. 4 finish.

C. Glass: ASTM C1036 annealed, and laminated, 4 mm thick; exposed edges ground; cut or drilled to receive hardware.

D. Laminate Backing Sheets: NEMA LD 3, BKL; unfinished, plastic laminate.

E. Finish Hardware: Manufacturer's standard.

F. Work Surfaces: Solid, laminated maple.

G. Fittings: Sink drains with crumb cup and waste fittings.

H. Service Outlet Covers and Escutcheons: Stainless Steel.

2.05 FABRICATION

A. Install rubber button feet on bearing surface of any item positioned on a finished surface.

B. Isolate rotating or reciprocating machinery to prevent noise and vibration.

C. Provide indirect drain piping from equipment to terminate over nearest waste receptor.

D. Accommodate site installation of other services or equipment.

2.06 FINISHES

A. Components: Shop finish.

B. Metal (Except Stainless Steel): Degrease and phosphate etch, prime and apply minimum two coats factory baked epoxy, color as selected.

C. Stainless Steel: No. 4 finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify ventilation outlets, service connections, and supports are correct and in required location.

B. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install items in accordance with manufacturers' instructions.

B. Insulate to prevent electrolysis between dissimilar metals.

C. Weld and grind joints in steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements.

D. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

E. Use anchoring devices appropriate for equipment and expected usage.

3.03 EXISTING EQUIPMENT

A. Obtain, move, store, and re-install equipment, ready for utility connection.

B. Do work in cooperation with St. Cloud School District 742 so that normal function of services is minimally interrupted.

C. Clean and re-furbish existing equipment to be re-used to original condition.

D. Where required, remove existing equipment from site for repairs or alterations; handle carefully and return in "like new" condition.

E. Re-used Equipment: Refer to schedule on drawings for re-used equipment.

3.04 ADJUSTING

A. Adjust equipment and apparatus to ensure proper working order and conditions.

B. Remove and replace equipment creating excessive noise or vibration.

3.05 CLEANING

A. Remove masking or protective covering from stainless steel and other finished surfaces.

B. Wash and clean equipment.

C. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

3.06 CLOSEOUT ACTIVITIES

A. At completion of work, provide qualified and trained personnel to demonstrate operation of each item of equipment and instruct St. Cloud School District 742 in operating procedures and maintenance.
   1. Test equipment prior to demonstration.
   2. Individual Performing Demonstration: Fully knowledgeable of all operating and service aspects of equipment.

3.07 PROTECTION

A. Remove protective coverings from prefinished work.

B. Protect finished work from damage.

3.08 FOODSERVICE EQUIPMENT SCHEDULE

A. Floor Trough (FT-1):
   1. Comply with NSF 2 construction.
   2. Construction: 16 gauge, 0.0598 inch (1.52 mm) stainless steel.
   3. Number of Grates: 1.
   4. Grating: Fiberglass, green.

END OF SECTION

SECTION 12 2400 - WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

B. Interior motorized roller shades.

C. Motor controls.

1.02 REFERENCE STANDARDS

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

B. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

C. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in St. Cloud School District 742's name and registered with manufacturer.

1.05 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.

1.06 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

A. See Section 01 7800 - 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: One year.

3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc: www.draperinc.com.
   2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com.
   3. MechoShade Systems LLC: www.mechoshade.com.
   4. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Motorized Roller Shades, Motors and Motor Controls:
   1. Draper, Inc: www.draperinc.com.
   2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com.
   3. MechoShade Systems LLC: www.mechoshade.com.
   4. SWFcontract, a division of Springs Window Fashions, LLC: www.swfcontract.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

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.
   3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
      a. Comply with NFPA 70.
      b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
      c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.

B. Roller Shades (WT-1) - Basis of Design: MechoShade Systems LLC; Mecho/5 System; www.mechoshade.com.
   1. Description: Single roller, manually operated fabric window shades.
      a. Drop Position: Regular roll.
      b. Mounting: Window jamb mounted.
      c. Size: As indicated on drawings.
      d. Fabric: As indicated under Shade Fabric article.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Material: Steel, 1/8 inch (3 mm) thick.
      b. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
         1) Light-Filtering Fabric: Room-side of opening.
         2) Room-Darkening Fabric: Glass-side of opening.
      c. Multiple Shade Band Operation: Provide hardware as necessary to operate more than one shade band using a single clutch operator.

3. Roller Tubes:
    a. Material: Extruded aluminum.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
    d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
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.
    b. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
    a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
    b. Brake must withstand minimum pull force of 50 lb (22.7 kg) in the stopped position.
    c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 lb (43 kg) minimum breaking strength. Provide upper and lower limit stops.
    a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
7. Accessories:
    a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.

C. Roller Shades (WT-2) - Basis of Design: MechoShade Systems LLC; ElectroShade with WhisperShade IQ2-DC EDU, low voltage (24 VDC); www.mechoshade.com.
1. Description: Single roller, motor-operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
    a. Mounting: Window jamb mounted.
    b. Size: As indicated on drawings.
    c. Fabric: As indicated under Shade Fabric article.
    d. Material: Steel, 1/8 inch (3 mm) thick.
    e. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
        1) Light-Filtering Fabric: Room-side of opening.
        2) Room-Darkening Fabric: Glass-side of opening.
    f. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
    g. Material: Extruded aluminum.
    h. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    i. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
    j. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.

k. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
    1) Audible Noise: 38 dBA or less measured 3 feet from motor unit, depending on motor torque.
    2) Capable of being configured to place motor into Override Mode when local switch commands shade to new position. Upon entering Override Mode, monitor and log positioning commands from automation devices, but do not act upon them until exiting Override Mode.
    3) Preventative Maintenance: Internally monitor important operating parameters to ensure motor and shade assembly are functioning properly.

l. Modes of Operation:
    1) Uniform Mode: Shades move only to defined intermediate stop positions to maintain aesthetic uniformity.
    2) Normal Mode: Shades move to defined intermediate stop positions plus any position between defined upper and lower limits.
    3) Maintenance Mode: Prevent shade from moving to newly commanded positions via dry contact or network control commands until EDU has been serviced or Maintenance Mode has been cleared or disabled.

m. Control Methods:
    1) Local isolated dry contact inputs support local switch control and third-party system integration without separate interface.
    2) Bidirectional network communication enables commanding operation of large groups of shades over common backbone.
    3) Provide minimum of three customizable preset positions accessible over network connection and local dry contact control inputs.
    4) Provide minimum of 32 customizable preset positions, including three local switch presets, accessible via network commands.

2. Accessories:
    a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.

2.03 SHADE FABRIC

A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
    1. Basis of Design: As indicated on drawings.

2.04 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
B. Provide all components and connections necessary to interface with other systems as indicated.
C. Manual Controls:
    1. Control Functions:
        a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
        b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
        c. Multiple Shade Groups: Provide individual controls for each shade group as indicated.

2. Wall Controls: Provided by shade manufacturer.
    a. Finish: To be selected by Architect.
    b. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.

2.05 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.
B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
    1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
    2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

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 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.
B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. Demonstration: Demonstrate operation and maintenance of window shade system to St. Cloud School District 742's personnel.
C. Training: Train St. Cloud School District 742'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 two hours training by manufacturer's authorized personnel at location designated by the St. Cloud School District 742.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 3553.13 - METAL LABORATORY CASEWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Metal laboratory casework.
   2. Filler and closure panels.
   3. Laboratory countertops.
   4. Tables.
   5. Shelves.
   6. Laboratory accessories.

B. Related Requirements:
   1. Section 06 1000 "Rough Carpentry" for wood blocking for anchoring laboratory casework.
   2. Section 09 2216 "Gypsum Board Assemblies" for reinforcements in metal-framed partitions for anchoring laboratory casework.
   3. Section 09 6500 "Resilient Flooring" for resilient base applied to metal laboratory casework.

1.02 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For laboratory casework. Include plans, elevations, sections, and attachment details.
   1. Indicate types and sizes of cabinets.
   2. Indicate locations of blocking and reinforcements required for installing laboratory casework.
   3. Include details of tables.
   4. Include details of countertops.
   5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of casework and equipment so that spaces are sufficiently complete that material can be installed immediately following delivery.

B. Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating.

C. Protect all work surfaces throughout construction period with 1/4" corrugated cardboard completely covering the top and securely taped to edges. Mark cardboard in large lettering "No Standing."

1.05 FIELD CONDITIONS

A. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. CIF Lab Solutions: www.cifsolutions.com.

B. Hamilton Laboratory Solutions: www.hamiltonlab.com.
C. Kewaunee Scientific Corporation: www.kewaunee.com.
D. LSI Industries: www.lsicorp.com.
E. Mott Manufacturing: www.mott.ca.
F. OnePointe Solutions: www.onepointesolutions.com.
G. Sheldon Laboratory Systems: www.sheldonlabs.com.
H. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.

2.02 PERFORMANCE REQUIREMENTS

A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity live loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:
   1. Steel base unit load capacity: 500 lbs. per lineal foot.
   2. Drawers in a cabinet body: 150 lbs.
   3. Hanging wall cases: 300 lbs.
   4. Load capacity for shelves of base units, wall cases and tall cases: 40 lbs. per square foot, maximum load – 200 lbs. up to 48” wide.
   5. Work Surfaces: 160 lb/ft. (240 kg/m).
   6. Vertical Riser Upright:
      a. Unit modules: Support 1,280 lbs. evenly balanced both sides.
      b. Shelves: Support a minimum of 180 lbs. - 6" to 12” deep shelves; 130 lbs. – 18” deep shelves; 100 lbs. - 24" deep shelves.
B. Metal Finish Performance Requirements:
   1. Abrasion resistance: Maximum weight loss of 5.5 mg. per 100 cycle when tested on a Taber Abrasion Tester #E40101 with 1000 gm wheel pressure and Calibrase #CS10 wheel.
   2. Humidity resistance: Withstand 1000 hour exposure in saturated humidity at 100 degrees F.
   3. No visible effect to surface finish following 100 hour continuous application of a water soaked cellulose sponge, maintained in a wet condition throughout the test period.
   4. Salt spray: Withstand minimum 200 hour salt spray test.
   5. Laboratory Casework Sefa 8 Metal Standards Requirements: Casework performance characteristics shall be in full compliance with current SEFA 8 Metal standards.

2.03 CASEWORK, GENERAL

A. General: Provide casework manufacturer's standard integrated system that includes support framing, modular cabinets, filler and closure panels, countertops, and fittings needed to assemble system. System includes hardware and fasteners for securing to permanent construction.
   1. Cabinets shall be fabricated as sectional units and be capable of being removed and reinstalled without use of special tools for relocation within system. Component parts of the unit shall be manufactured ensuring uniformity, interchangeability and accurate alignment. All base cabinets shall have integral enclosed bases.
   2. Base cabinets allow for field conversion of cabinet door and drawer front styles, drawer body suspension systems and cabinet horizontal and vertical support rails with the use of simple hands tools.

3. System includes filler and closure panels to close spaces between support framing, cabinets, shelves, countertops, floors, and walls, unless otherwise indicated. Fabricate panels from same material and with same finish as cabinets and with hemmed or flanged edges.
4. System includes wall-mounted casework that matches all other laboratory casework in design and material.

B. Casework Product Standard: Comply with SEFA 8 M, "Laboratory Grade Metal Casework."

2.04 COUNTERTOPS

A. Countertops:
1. Epoxy Resin Countertops (EPXY-#): Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
a. Flat Surface Thickness: 1 inch (25 mm), nominal.
b. Surface Finish: Smooth, non-glare.
c. Color: Black.
d. Exposed Edge Shape: 3/16 inch (5 mm) radius corner.
e. Back and End Splashes: Same material, same thickness; separate for field attachment.

2.05 METAL CABINETS (MTL CASE-#)

A. Fabrication: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt- and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch (1.5 to 2.4 mm).

B. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.

C. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.

D. Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal.

E. Adjustable Shelves: Front, back, and ends formed down 1 inch, with edges returned horizontally at front and back to form reinforcing channels.

F. Toe Space: Fully enclosed, 4 inches (100 mm) high by 2 - 3 inches (50 - 75 mm) deep, with no open gaps or pockets.

G. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets and with hemmed or flanged edges unless otherwise indicated.
1. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed. Fabricate from back-to-back panels or of hollow construction to eliminate exposed hemmed or flanged edges.
2. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
3. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.

2.06 METAL CABINET FINISH

A. General: Prepare, treat, and finish welded assemblies after assembling. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.

B. Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Electrostatically apply urethane powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thickness:
    a. Exterior and interior exposed surfaces: 1.5 mil average and 1.2 mil min.
    b. Backs of cabinets and other surfaces not exposed to view: 1.2 mil average.
    c. Interior and shelves of flammable liquid storage cabinets: 3 mil min.
    d. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8 M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
2. Colors for Metal Laboratory Casework Finish: As indicated on drawings.

2.07 HARDWARE

A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Stainless steel, #4 finish, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 48 inches (1200 mm) and less in height and 3 for doors more than 48 inches (1200 mm) in height, four for doors 84” or more in height.

1. Inset steel, stainless steel, 5-knuckle

C. Drawer and Door Pulls: Pulls fastened from back with two screws. For sliding doors, provide stainless steel or chrome-plated recessed flush pulls. Provide two (2) pulls for drawers more than 24 inches (600 mm) in width.

1. Stainless steel wire.

D. Door Catches: Nylon-roller spring loaded, self-aligning, catch with a steel strike plate. Double doors without locks shall have a catch on each door. Tall cases shall have latching devices located on the structurally fixed center shelf. The left hand door shall have a positive catch and the right hand door shall have a roller type catch where locks are used. Where locks are used, catches and strike plates shall be used on left hand doors of double door cases and shall be steel, cadmium plated. Provide 2 catches on doors more than 48 inches (1200 mm) in height.

E. Drawer Slides: Full-extension, heavy-duty, zinc plated drawer slides; designed to prevent rebound when drawers are closed; SEFA 8 Metal complaint and rated for 100 lbs and 150 lbs. full extension slides; 150 lbs slides standard on all file drawers. Drawer slides shall have an integral stop mechanism to avoid inadvertent removal. Self-closing and soft-closing slides are BIFMA rated.

1. 100 lbs. full extension, SEFA 8 Metal
2. 150 lbs. full extension, SEFA 8 Metal

F. Shelf Adjustment: Adjustable shelf support clips are designed for adjusting shelves on 1.26” (35 mm) centers and shall be painted steel complying with BHMA A156.9, Type B04013. In addition to shelf clips required for initial assembly, six (6) dozen additional clips to be provided to the owner.

G. Adjustable Leveling Devices: Each base cabinet shall have leveling devices, 3/8”-16, 2.5” long similar to model # 2500T32 as manufactured by McMaster-Carr Supply Company, New Brunswick, NJ.

2.08 COUNTERTOPS

A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch (25 mm), with continuous drip groove on underside 1/2 inch (13 mm) from edge.

B. Epoxy Countertops:

1. Countertop Fabrication: Fabricate with cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.
    a. Countertop Configuration: Flat, 1 inch (25 mm) thick, with beveled edge and corners, and with drip groove and integral coved backsplash.

2.09 MISCELLANEOUS MATERIALS

A. Elastomeric Joint Sealant: ASTM C 920; silicone. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF CABINETS

A. Comply with installation requirements in SEFA 2.3. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet (1.5 mm in 3 m).
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet (3 mm in 3 m).
3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet (3 mm in 3 m).
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.5 mm).

B. Base Cabinets: Fasten cabinets to partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 16 inches (400 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches (600 mm) o.c. and at sides of cabinets with not less than two fasteners per side.

C. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 16 inches (400 mm) o.c.

D. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

E. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

F. The assemblies listed below are to be fastened together with devices of adequate strength to support cabinet of shelf fully loaded. Fully loaded at (40) LBS. per square, up to 200 lbs., foot per shelf for enclosed wall cabinets or open adjustable shelves not inclusive of cabinet, shelf and bracket weight. Securely fasten wall-mounted items to solid supporting material only.
   1. Wall cabinet to wall
   2. Adjustable shelf to wall
   3. Pegboard to wall
   4. Adjustable shelf to slotted stud

3.03 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

C. Fastening:
   1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.

D. Provide required holes and cutouts for service fittings.

E. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

F. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.04 INSTALLATION OF LABORATORY ACCESSORIES

A. Install accessories according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions.

B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.

C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

D. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.05 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil (0.15-mm) plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches (1200 mm) o.c.

END OF SECTION

SECTION 12 3553.19 - PLASTIC LAMINATE LABORATORY CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard and custom wood cabinets and cabinet hardware.
B. Laboratory sinks.
C. Pegboards.
D. Service fittings and outlets.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: Requirements for sustainably harvested wood.
B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: VOC limitations for adhesives and sealants.
C. Section 07 9200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches (1.066 m) above finished floor, tops of cases less than 72 inches (1.82 m) above finished floor and all members visible in open cases or behind glass doors.
B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches (1.828 m) above finished floor and bottoms of cabinets more than 30 inches (0.762 m) but less than 42 inches (1.066 m) above finished floor.
C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches (762 mm) above finished floor.

1.04 REFERENCE STANDARDS

A. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2024.
B. SEFA 3 - Laboratory Work Surfaces; 2010.
C. SEFA 7 - Laboratory Fixtures; 2010.
D. SEFA 8W - Laboratory Grade Wood Casework; 2020.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Component dimensions, configurations, construction details, joint details, attachments; manufacturer's catalog literature on hardware, accessories, and service fittings, if any.
C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements placement dimensions and tolerances, clearances required, and utility locations, if any. Include coordinated information for laboratory equipment specified in another section and/or furnished by Owner.
D. Samples For Color Selection: Wood samples, fully finished, for color and species selection. Minimum Sample Size: 2 inches by 3 inches (51 mm by 75 mm).
E. Test Reports: From independent laboratory indicating compliance with referenced chemical-resistance standards for cabinet finish and liner materials.
F. Manufacturer's installation instructions.

G. Maintenance Data: Manufacturer's recommendations for care and cleaning.

H. Finish touch-up kit for each type and color of materials provided.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Acceptance at Site:

1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:

1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" paragraph of this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Laboratory Casework:

1. CIF Lab Solutions: www.cifsolutions.com.
2. Hamilton Laboratory Solutions: www.hamiltonlab.com.
3. Kewaunee Scientific Corporation: www.kewaunee.com.
4. LSI Industries: www.lsicorp.com.
5. Mott Manufacturing: www.mott.ca.
6. OnePointe Solutions: www.onepointesolutions.com.
7. Sheldon Laboratory Systems: www.sheldonlabs.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PLAM LABORATORY CASEWORK

A. Plam Laboratory Casework (LAB CASE-#): Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.

1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings.
3. Construction: Joints doweled, glued and screwed, except drawers may be lock-shoulder jointed; with interior of units smooth and flush; cabinet bottom flush with top of face frame; without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
4. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7, and SEFA 8W, components safely support the following minimum loads:
    a. Base Units: 500 pounds per linear foot (744 kgs/linear m) across the cabinet ends.
    b. Suspended Units: 300 pounds (136 kg) static load.
    c. Tables: 300 pounds (136 kg), minimum, on four legs.

d. Drawers: 125 pounds (57 kg), minimum.
e. Hanging Wall Cases: 300 pounds (135 kg).
f. Shelves: 100 pounds (45 kg), minimum.

5. Provide movable units with casters at locations indicated for ADA accessibility. Casters shall have locking mechanism to prevent rolling.
6. Fittings and Fixture Locations: Cut and drill counter tops, backs, and other components for service outlets and fixtures.
7. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.
8. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
9. Factory-finish all exposed and semi-exposed surfaces with the same finish.
    a. Finish Performance: Provide finish on all surfaces having chemical resistance of Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8W and no visible effect when surface is exposed to:
        1) Hot water at temperature between 190 degrees F (88 degrees C) and 205 degrees F (96 degrees C) trickled down the test surface at 45 degree angle for 5 minutes.
        2) Constant moisture in the form of 2 by 3 by 1 inch (51 by 76 by 25 mm) thick cellulose sponge kept continually saturated with water and in contact with test surface for 100 hours.
    b. Preparation: Wood sanded smooth, free from dust and mill marks.
    c. Stain: Single application of clean, manufacturer-recommended stain of selected color; tinted coating not acceptable.
    d. Coating: Clear, superior-quality, chemical-resistant acyclic urethane; applied in accordance with manufacturer instructions, force-dried, sanded and wiped clean.
    e. Coats: Multiple coats as required to achieve minimum 1.5 mil (0.038 mm) dry film thickness.
    f. Appearance: Clear satin gloss; not cloudy or muddy.

2.03 CABINET HARDWARE

A. Manufacturer's standard types, styles, and finishes, and as indicated below.
B. Finish of exposed stainless steel components: No.4 finish.
C. Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 2 keys per lock.
D. Shelves in Cabinets:
    1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.
E. Swinging Doors:
    1. Hinges: Butt, number as required by referenced standards for width, height, and weight of door.
        a. European-Style Hinges: For overlay doors, concealed. Steel, nickel-plated, 110 degree opening angle.
    2. Catches: Magnetic.
    3. Pulls: Chrome wire pulls, 4 inches (102 mm) wide.
    4. Drawers:
        a. Pulls: Chrome wire pulls, 4 inches (102 mm) wide.
        b. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.04 METAL LABORATORY TABLE (LAB TABLE-#)

A. Basis of Design: OnePointe Solutions: www.onepointesolutions.com.

B. Product: Mobile tables with 1.5 inch square tubular steel frame ground smooth and epoxy tops. Pin height adjustable from 28 inches to 37 inches. See drawings for sizes.

C. Frame Material: 1.5 inch sqaure tubular steel frame, fully welded and ground smooth.

1. Finish: Powder-coated.

D. Top: 1 inch thick epoxy.

E. Total Locking Casters: 4 inch diameter; Total Height: 5 inches.

2.05 COUNTERTOPS

A. Epoxy Resin Countertops (EPXY-#): Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.

1. Flat Surface Thickness: As indicated on drawings.
2. Surface Finish: As indicated on drawings.
3. Color: As indicated on drawings.
4. Exposed Edge Shape: As indicated on drawings.
5. Back and End Splashes: As indicated on drawings.

2.06 SINKS (SINK-#)

A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.

1. Physical Properties:
   a. Flexural Strength: Not less than 10,000 psi (70 MPa).
   b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
   c. Hardness (Rockwell M): Not less than 100.
   d. Water Absorption (24 Hours): Not more than 0.02 percent.
   e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
2. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
   a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
3. Color: Black.

2.07 PEGBOARDS (PEG BD-#)

A. Epoxy pegboards with pre-drilled or punched holes in a staggered pattern, designed to accept removable white polypropylene pegs. With each pegboard include a stainless steel drip-trough with drain outlet and matching diameter 36 inches (914 mm) long PVC drain hose.

1. Size: As indicated on drawings.

2.08 LABORATORY EMERGENCY EQUIPMENT PLUMBING FIXTURES

A. Eyewash/Drench Hose Units: Deck-mounted, dual-purpose units. Designed for use as a fixed eyewash when unit is left in deck flange, and as a drench hose when removed from deck flange.

2.09 SERVICE FITTINGS

A. General: Comply with requirements of SEFA 7.

B. Gas Service Fittings and Fixtures: By Mechanical Contractor.

C. Water Service Fittings and Fixtures: By Mechanical Contractor.

D. Electrical Fittings and Fixtures: By Mechanical Contractor.

2.10 MATERIALS - PLAM CASEWORK

A. Adhesives Used for Assembly: Comply with VOC limitation requirements for adhesives and sealants, see Section 01 6116.

B. Wood-Based Materials:

1. Certified as sustainably harvested, see Section 01 6000.
2. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
3. Composite Wood Panels: Containing no urea-formaldehyde resin binders. See Section 01 6116.

C. Exposed Solid Wood: Clear, dry, sound, plain sawn, selected for compatible grain and color, no defects.

D. Exposed Hardwood Plywood: Veneer core; HPVA HP-1 Grade AA, Type I; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.

E. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.

F. Semi-Exposed Hardwood Plywood: Veneer core; HPVA HP-1 Grade C, Type I; plain sliced, any species similar in color and grain to exposed portions.

G. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.

H. Sealant for Use in Casework Construction: Manufacturer's recommended type.

2.11 ACCESSORIES

A. Upright Rod Socket: Provide (8 per each lab).

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Environmental Conditions:

1. Do not deliver casework until the following conditions have been met:
    a. Building has been enclosed (windows and doors sealed and weather-tight).
    b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
    c. Ceiling, overhead ductwork, piping, and lighting have been installed.
    d. Installation areas do not require further “wet work” construction.

B. Verify adequacy of support framing and anchors.

C. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

A. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

B. Set casework items plumb and square, securely anchored to building structure.

1. Base Cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 3/4 inch (19 mm) leveling

adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.

2. Wall Cabinets: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
    a. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more, and/or maximum variation from plumb exceeds 1/4 inch (6 mm) per story.
    b. Maximum Variation of finished gypsum board surface from true flatness exceeds 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

C. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

D. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:
    1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
    2. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
    3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
    4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).

E. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

G. Countertops: Install countertops in one true plane, with ends abutting at hairline joints, and no raised edges.

H. Replace units that are damaged, including those that have damaged finishes.

3.03 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.

C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

A. Division 22 - Plumbing fixtures, sinks.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

F. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Installation Instructions: Manufacturer's installation instructions and recommendations.

F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Solid Surfacing Countertops (SSM-#): Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Basis of Design: See drawings for product information.
   2. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
   3. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
   4. Other Components Thickness: 1/2 inch (12 mm), minimum.
   5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

2.02 MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.
   2. Provide sustainably harvested wood, certified or labeled; see Section 01 6000 - Product Requirements.
B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
C. Countertop Support Members: Furniture grade, epoxy powder coated steel.
   1. Basis of Design: Rakks Model EH-1818FM with cover bracket as manufactured by Rangine Corporation or approved equal.
D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.
   3. Detail top of backsplash to allow scribing of backsplash to wall.
C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 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. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach countertops using compatible adhesive as well as mechanical fasteners.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 CLEANING

A. Clean countertops surfaces thoroughly.

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 21 05 00 – COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes pipe, fittings, valves, and connections for wet pipe and standpipe systems.

B. Related Sections:
   1. Section 23 05 16 – Expansion Fittings and Loops for HVAC Piping: Product and execution requirements for thermal expansion of piping.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
   2. ASME B16.25 - Buttwelding Ends.
   3. ASME B16.3 - Malleable Iron Threaded Fittings.
   4. ASME B16.4 - Gray Iron Threaded Fittings.
   5. ASME B16.5 - Pipe Flanges and Flanged Fittings.
   6. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.

B. ASTM International:
   1. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   2. ASTM A795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

C. National Fire Protection Association:
   1. NFPA 13 - Installation of Sprinkler Systems.
   2. NFPA 14 - Standard for the Installation of Standpipe, Private Hydrants and Hose Systems.
   3. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.
   4. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.3 SYSTEM DESCRIPTION

A. Fire suppression system to be wet-sprinkler type. Refer to Section 21 13 13.

1.4 SUBMITTALS

A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and tag numbering.

B. Operation and Maintenance Data: Submit spare parts lists.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with NFPA 13 and any insurance requirements

C. All materials used to be UL listed.

D. Commercial Cooking Equipment and Ventilation Applications: Perform work in accordance with NFPA 13, NFPA 96, Minnesota Mechanical Code, and Minnesota Fire Code.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Furnish cast iron and steel valves with temporary protective coating.

C. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9 COORDINATION

A. Fire Protection Contractor shall be required to coordinate installation requirements and construction schedules to install equipment in new or existing facilities.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are required.

C. Coordinate connections with exterior utilities as required.

D. Coordinate requirements for access panels and doors with General Contractor if fire suppression items installed in concealed locations require access.

1.10 WARRANTY

A. Furnish one year manufacturer warranty for basic fire suppression materials and methods (excludes existing systems).

PART 2 PRODUCTS

2.1 VALVES

A. Gate Valves:
   1. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.
   2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged ends.
   3. Over 4 inches: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, and iron body indicator post assembly.

B. Globe Valves:
   1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable rubber disc, threaded ends, with back seating capacity.
   2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

C. Ball Valves:
   1. Up to and including 2 inches: Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, Teflon seats and stuffing box ring, lever handle, threaded ends.
   2. Over 2 inches: Manufacturers: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged.

D. Butterfly Valves:
   1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device.

2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device.

E. Check Valves:
1. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends.
2. Over 2 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
3. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

F. Drain Valves:
1. Compression Stop: Bronze with hose thread nipple and cap.
2. Ball Valve: Brass with cap and chain, 3/4 inchhose thread.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 UL listed; Schedule 10 black.
1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
a. Grooved Reducer Couplings: Not Allowed.
5. Mechanical Formed Fittings: Carbon-steel housing with integral pipe stop and O-ring pocked and O-ring uniformly compressed into permanent mechanical engagement onto pipe.

2.3 PIPE HANGERS AND SUPPORTS

A. Wet Sprinkler Systems: Conform to NFPA 13

B. Standpipe Systems: Conform to NFPA 14.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable, clevis.

D. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

G. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

H. Vertical Support: Steel riser clamp.

I. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. In exposed areas, prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

3.2 INSTALLATION

A. Install piping in accordance with NFPA 13 for sprinkler systems and NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install pipe sleeve at piping penetrations through footings, partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
   1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
   2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

G. Pipe Hangers and Supports:
   1. Install in accordance with NFPA 13 for wet sprinkler systems and NFPA 14 for standpipe systems.
   2. Install hangers to with minimum 1/2 inch space between finished covering and adjacent work.
   3. Place hangers within 12 inches of each horizontal elbow.
   4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.

H. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.

I. Do not penetrate building structural members unless indicated.

J. Projects with existing systems: piping connecting to existing systems shall match the materials and methods of the existing system.

K. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.

L. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

N. Install butterfly valves for shut-off or isolating service.

O. Install drain valves at main shut-off valves, low points of piping and apparatus.

P. Where inserts are omitted, drill through concrete slab from below and install through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 CLEANING

A. Only clean areas affected by Work. Clean after other construction is complete.

END OF SECTION

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SECTION 21 13 13 – WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system, system design, installation, and certification.

B. Related Sections:
   1. Section 21 05 00 - Common Work Results for Fire Suppression: Product and execution requirements for pipe, fittings, valves, hangers, supports, identification, and painting for placement by this section.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 13 - Installation of Sprinkler Systems.
   2. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
   3. NFPA 101 – Life Safety Code.
   4. NFPA 654 – Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Solids.

B. National Institute for Certification in Engineering Technologies:
   1. Level III – Hydraulics and Water Supply Planning.

1.3 SYSTEM DESCRIPTION

A. Kitchen Hoods: Provide fire suppression systems as required per NFPA 96 and local codes.

B. System to provide coverage for entire building.

C. Fire protection penetration of storm shelter must be protected per ICC-500 requirements. Provide cyclone style shroud for penetration, or coordinate penetration location with architecturally protected baffle system.

D. New commons area fire protection piping must be routed within and heads must be concealed within removable roof access paneling system. See architectural details for more information

E. Provide hydraulically designed system to NFPA 13 occupancy requirements. System to have a minimum safety factor of 5 PSI.

F. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data become available prior to submittals.

G. Interface system with building fire and smoke alarm system.

H. Provide fire department connections as required by Authority Having Jurisdiction.

I. Additional compensation will not be allowed for modification to the Construction Documents for additional piping, sprinklers, offsets, coordination, or additional hydraulic calculations.

1.4 SUBMITTALS

A. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

B. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Design Data: Submit design calculations.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

B. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 13.

B. All materials used are to be UL listed.

C. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

C. Design system under direct supervision of a licensed Professional Engineer or a NICET Level III Certified Technician.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers until installation.

B. Furnish piping with temporary inlet and outlet caps until installation.

1.9 WARRANTY

A. Furnish one year manufacturer warranty for all items included in the fire sprinkler systems (excludes existing systems).

1.10 EXTRA MATERIALS

A. Furnish extra sprinklers under provisions of NFPA 13.

B. Furnish suitable wrenches for each sprinkler type.

C. Furnish metal storage cabinet near system riser (not necessary for existing systems with furnished cabinet).

PART 2 PRODUCTS

2.1 WET-TYPE SPRINKLERS

A. Manufacturers:
   1. Globe Sprinkler
   2. Reliable Sprinkler
   3. Tyco Sprinkler
   4. Victaulic Sprinkler

B. Suspended Ceiling Type:
   1. Type: Concealed pendant type with matching escutcheon plate.
   2. Finish: Enamel, color white (or match existing).

3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Exposed Area Type:
   1. Type: Standard upright or pendent type.
   2. Finish: Brass (or match existing).
   3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Sidewall Type (Type 1):
   1. Type: Recessed horizontal sidewall type with matching push on escutcheon plate.
   2. Finish: Chrome plated (or match existing).
   3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

E. Sidewall Type (Type 2):
   1. Type: Standard horizontal sidewall type.
   2. Finish: Brass (or match existing).
   3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

F. Escutcheon Plate: Finish to match sprinkler finish

G. Guards: Finish to match sprinkler finish.

2.2 PIPE

A. Refer to Section 21 05 00.

B. Drains may be of any acceptable piping for fire sprinkler systems.

2.3 FITTINGS

A. Refer to Section 21 05 00.

B. All fittings to be rated for a minimum of 125 PSI.

2.4 VALVES

A. Refer to Section 21 05 00.

B. All valves to be mechanically coupled, flanged, or threaded.

C. System Riser Valves:
   1. Indicating Type Butterfly Valves, or
   2. Outside Screw and Yoke Gate Valves.

D. Electronic Supervision:
   1. Valves that shut down water flow to any areas of the sprinkler systems shall be electronically supervised.
   2. Valves for main or auxiliary drains do not need to be electronically supervised.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. All wiring for the sprinkler system to be provided by the Sprinkler Contractor and installed by a licensed Electrician.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13.

B. Place pipe runs to minimize obstruction to other work.

C. Install piping in concealed spaces above finished ceilings.

D. Assembly Penetrations

1. Exposed Areas: Provide escutcheons for wall penetrations. Escutcheons to have chrome finish.
2. Fire-rated Assemblies: Provide UL listed firestopping system with a fire rating no less than the rated assembly.
3. Smoke-rated Assemblies: Provide UL listed smoke control system with a smoke rating no less than the rated assembly.

E. Center sprinklers in two directions in ceiling tile and install piping offsets.

F. Install guards on sprinklers less than 7 feet above the finished floor.

G. Hydrostatically testing
1. New Construction: Test entire system.
2. Existing Systems: Test modified systems.

H. Require test be witnessed by Authority Having Jurisdiction

3.2 INSTALLATION: KITCHEN HOODS

A. Install systems per NFPA 96 and local codes.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Verify signal devices are installed and connected to fire alarm system.

3.4 CLEANING

A. Refer to Section 21 05 00.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting.

END OF SECTION

SECTION 22 05 29 – HANGERS & SUPPORTS FOR PLBG PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Inserts.
   4. Flashing.
   5. Sleeves.
   6. Mechanical sleeve seals.
   7. Formed steel channel.
   8. Firestopping relating to plumbing work.
   9. Firestopping accessories.
   10. Equipment bases and supports.

B. Related Sections:
   1. Section 22 11 00 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
   2. Section 22 13 00 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.
   3. Section 22 14 00 - Facility Storm Drainage: Execution requirements for placement of hangers and supports specified by this section.
   4. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product and execution requirements for vibration isolators.

1.2 REFERENCES

A. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

1.3 SUBMITTALS

A. NONE.

1.4 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Coordinate Work with other trades.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Anvil International (Mueller Water Products, Inc.).
2. Carpenter & Paterson Inc.
3. Creative Systems Inc.
4. Flex-Weld, Inc.
5. Globe Pipe Hanger Products Inc.
6. Michigan Hanger Co.
7. Superior Valve Co.

B. Plumbing Piping - DWV:
1. Conform to MSS SP 69.
2. Hangers for Pipe Sizes ½- to 1-½-inch: Malleable iron or Carbon steel, adjustable, clevis.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
10. For Exterior and Humid Areas: Furnished hot-dipped galvanized or Type 304 stainless steel or better hangers, support, and hardware.

C. Plumbing Piping - Water:
1. Conform to MSS SP 69.
2. Hangers for Pipe Sizes ½- to 1-½-inch: Malleable iron or Carbon steel, adjustable, clevis.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 inchesand Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, Carbon-steel ring.
16. For Exterior and Humid Areas: Furnished hot-dipped galvanized or Type 304 stainless steel or better hangers, support, and hardware.

D. Plumbing Piping - Storm:
1. Conform to MSS SP 69.
2. Hangers for Pipe Sizes ½- to 1-½-inch: Malleable iron or Carbon steel, adjustable, clevis.
3. Hangers for Pipe Sizes 2 inchesand Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inchesand Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inchesand Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.

2.2 HANGER RODS

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. See Division 07.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire-rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire-rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Acrylic.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc.
2. NMP Corporation.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber-sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage thick steel. With holes 1-½-inches on center.

2.8 FIRESTOPPING

A. Refer to Division 07.

2.9 FIRESTOPPING ACCESSORIES

A. Refer to Division 07.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Obtain permission from Architect/Engineer before using powder-actuated anchors.

B. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below, and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with MSS SP 69.

B. Support horizontal piping as scheduled. Coordinate with Structural Drawings.

C. Support vertical piping as scheduled.

D. Install hangers with minimum ½-inch space between finished covering and adjacent work.

E. Place hangers within 12 inches of each horizontal elbow.

F. Use hangers with 1-½-inch minimum vertical adjustment.

G. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

N. Provide vibration isolators type hangers or supports for pipes after vibration-isolated equipment is installed. Refer to Section 23 05 48.

O. Provide vibration isolators type hangers for pipes 2-inches or larger located below or within 50 feet of noise-sensitive rooms. Refer to Section 23 05 48.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Refer to Section 23 05 29 for installation requirements.

3.6 INSTALLATION - FLASHING

A. Refer to Division 07.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

A. Install firestopping material at fire and smoke-rated construction perimeters and openings containing penetrating sleeves, piping, and other items that require firestopping.

B. Refer to Division 07.

3.9 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.10 SCHEDULES

HANGERS AND SUPPORTS (TABLE 313.1)MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
CAST	LEAD AND OAKUM	5 FEET, EXCEPT 10 FEET WHERE 10 FOOT LENGTHS ARE INSTALLED (NOTES 1,2,3)	BASE AND EACH FLOOR, NOT TO EXCEED 15 FEET
CAST	COMPRESSION GASKET	EVERY OTHER JOINT, UNLESS OVER 4 FEET THEN SUPPORT EACH JOINT (NOTES 1,2,3)	BASE AND EACH FLOOR, NOT TO EXCEED 15 FEET
CAST-IRON HUBLESS	SHEILDED COUPLING	EVERY OTHER JOINT, UNLESS OVER 4 FEET THEN SUPPORT EACH JOINT (NOTES 1,2,3,4)	BASE AND EACH FLOOR, NOT TO EXCEED 15 FEET
COPPER TUBE AND PIPE	SOLDERED OR BRAZED	1-1/2 INCHES AND SMALLER, 6 FEET; 2 INCHES AND LARGER, 10 FEET	EACH FLOOR, NOT TO EXCEED 10 FEET (NOTE 5)
STEEL AND BRASS PIPE FOR WATER OR DWV	THREADED OR WELDED	3/4 INCH AND SMALLER, 10 FEET; 1 INCH AND LARGER, 12 FEET	EVERY OTHER FLOOR, NOT TO EXCEED 25 FEET (NOTE 5)
STEEL, BRASS, AND TINNED COPPER PIPE FOR GAS	THREADED OR WELDED	1/2 INCH, 6 FEET; 3/4 INCH AND 1 INCH, 8 FEET; 1-1/4 INCHES AND LARGER, 10 FEET	1/2 INCH, 6 FEET; 3/4 INCH AND 1 INCH, 8 FEET; 1-1/4 INCHES EVERY FLOOR LEVEL

SCHEDULE 40 PVC AND ABS DWV	SOLVENT CEMENTED	ALL SIZES, 4 FEET; ALLOW FOR EXPANSION EVERY 30 FEET (NOTES 3,6)	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES; PROVIDE FOR EXPANSION EVERY 30 FEET (NOTE 6)
CPVC	SOLVENT CEMENTED	1 INCH AND SMALLER, 3 FEET; 1-1/4 INCHES AND LARGER, 4 FEET	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES (NOTE 6)
LEAD	WIPED OR BURNED	CONTINUOUS SUPPORT	NOT TO EXCEED 4 FEET
COPPER	MECHANICAL	IN ACCORDANCE WITH STANDARDS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION	IN ACCORDANCE WITH STANDARDS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION
STEEL AND BRASS	MECHANICAL	IN ACCORDANCE WITH STANDARDS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION	IN ACCORDANCE WITH STANDARDS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION
PEX	COLD EXPANSION, INSERT AND COMPRESSION	1 INCH AND SMALLER, 32 INCHES; 1-1/4 INCHES AND LARGER, 4 FEET	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES
PEX-AL-PEX	METAL INSERT AND METAL COMPRESSION	1/2 INCH, 3/4 INCH, 1 INCH; ALL SIZES 98 INCHES	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES
PE-AL-PE	METAL INSERT AND METAL COMPRESSION	1/2 INCH, 3/4 INCH, 1 INCH; ALL SIZES 98 INCHES	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES
POLYPROPYLENE (PP)	FUSION WELD (SOCKET, BUTT, SADDLE, ELECTROFUSION), THREADED (METAL THREADS ONLY), OR MECHANICAL	1 INCH AND SMALLER, 23 INCHES; 1-1/4 INCHES AND LARGER, 4 FEET	BASE AND EACH FLOOR; PROVIDE MID-STORY GUIDES

NOTES:

1. SUPPORT ADJACENT TO JOINT, NOT TO EXCEED 18 INCHES.
2. BRACE NOT TO EXCEED 40 FOOT INTERVALS TO PREVENT HORIZONTAL MOVEMENT.
3. SUPPORT AT EACH HORIZONTAL BRANCH CONNECTION.
4. HANGERS SHALL NOT BE PLACED ON THE COUPLING.
5. VERTICAL WATER LINES SHALL BE PERMITTED TO BE SUPPORTED IN ACCORDANCE WITH RECOGNIZED ENGINEERING PRINCIPLES WITH REGARD TO EXPANSION AND CONTRACTION, WHERE FIREST APPROVED BY THE AUTHORITY HAVING JURISDICTION.
6. SEE THE APPROPRIATE IAPMO INSTALLATION STANDARD FOR EXPANSION AND OTHER SPECIAL REQUIREMENTS.

HANGER AND ROD SIZES (TABLE 313.6)

PIPE AND TUBE SIZE	ROD SIZE
(INCHES)	(INCHES)
1/2 - 4	3/8
5 - 8	1/2
10 - 12	5/8

END OF SECTION

SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Pipe markers.
   5. Ceiling tacks.
   6. Labels.
   7. Lockout devices.

B. Related Sections:
   1. NONE.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. National Fire Protection Association:
   1. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

A. The Plumbing Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. NONE.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags:
   1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches square.

B. Metal Tags:
   1. Brass, Aluminum, or Stainless Steel with stamped letters; tag size minimum 1-½-inches square with finished edges.

C. Information Tags:
   1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-¼ x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum or plastic laminated frame.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. Up to 2 inches Outside Diameter of Insulation or Pipe: ½-inch high letters.
   2. 2-½ to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
   3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-¾ inches high letters.
   4. Ductwork and Equipment: 1-¾ inches high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PLASTIC MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Markers:
   1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Markers:
   1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Markers:
   1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

A. Description: Steel or plastic with ¾-inch diameter color-coded head.

B. Color code as approved by Owner. If no preference by Owner, color as follows:
   1. Plumbing valves: Green.
   2. Refer to Section 23 05 53 for other equipment.

2.6 LABELS

A. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Reinforced nylon hasp with erasable label surface; size minimum 7-¼ x 3 inches.

B. Valve Lockout Devices:
   1. Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic markers, or plastic tape markers.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification:
      a. Not to exceed 20 feet on straight runs including risers and drops.
      b. Adjacent to each valve and tee.
      c. At each side of penetration of structure or enclosure.
      d. At each obstruction.

J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 22 07 00 – PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Piping system insulation.
   2. Equipment insulation.
   3. Pipe insulation jackets.
   4. Equipment insulation jackets.
   5. Insulation accessories including vapor retarders and accessories.

B. Related Sections:
   1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and Execution requirements for inserts at hanger locations.
   2. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for plumbing piping and equipment identification.
   3. Section 23 07 00 – HVAC Insulation: Pipe insulation thickness requirements.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   2. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
   3. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

A. NONE.

1.4 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

B. Maintain temperature during and after installation for minimum period as recommended by manufacturer.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE: MAN MADE MINERAL FIBER

A. Insulation: ASTM C547 Mineral Fiber Pipe Insulation, Type I, 850 °F
   1. Insulation Conductivity Rating: Maximum: 0.28 Btu-in/(h-ft2-°F) at 100-°F mean rating temperature.

B. Applications on Austenitic stainless steel: Conform to ASTM C795.

C. Vapor Retarder Jacket:
   1. White Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

D. Vapor Retarder Lap Adhesive:
   1. Compatible with insulation.

2.2 PIPE INSULATION AND EQUIPMENT JACKETS

A. PVC Plastic Pipe Jacket:
   1. Product Description: One-piece molded type fitting covers and sheet material, off-white color.
   2. Thickness: 10 mil.
   3. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping and equipment has been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION – PIPING

A. Exposed Piping: Locate insulation and cover seams in least visible locations.

B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, [pump bodies,] and expansion joints.

C. Manmade mineral fiber insulated pipes conveying fluids below ambient temperature:
   1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. For hot piping conveying fluids over 140 °F, insulate flanges and unions at equipment.

E. Manmade mineral fiber insulated pipes conveying fluids above ambient temperature:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Inserts and Shields:

1. Application: Piping or Equipment 2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under finish jacket.
4. Insert configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be site fabricated or factory fabricated.
5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.

G. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

H. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.

I. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

J. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with [aluminum] [stainless steel] jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

E. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

F. Mineral fiber insulated equipment containing fluids below ambient temperature: Provide vapor retarder jackets, factory-applied or field-applied. Finish with glass-cloth and vapor barrier adhesive.

G. For hot equipment containing fluids over 140 °F, insulate flanges and unions with removable sections and jackets.

H. Mineral fiber insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor retarder, factory-applied or field-applied. Finish with glass cloth and adhesive.

I. Finish insulation at supports, protrusions, and interruptions.

J. Nameplates and ASME Stamps: Bevel and seal insulation around. Do not insulate over.

K. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Systems:
      a. Material: Man Made Mineral Fiber Insulation
      b. Thickness:
         1) Pipe diameter less than 1-½-inches: 1 inch.
         2) Pipe diameter 1-½-inches and greater: 1-½-inches.
   2. Domestic Cold-Water Systems:
      a. Material: Man Made Mineral Fiber Insulation
      b. Thickness: 1 inch.
   3. Roof Drainage:
      a. Material: Man Made Mineral Fiber Insulation
      b. Thickness: 1 inch.
   4. Plumbing Vents Within 10 feet of Exterior:
      a. Material: Man Made Mineral Fiber Insulation
      b. Thickness: 1 inch.

END OF SECTION

SECTION 22 11 00 – FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Domestic water piping, below grade.
   2. Domestic water piping, above grade.
   3. Unions and flanges.
   4. Valves.
   5. Pipe hangers and supports.
   6. Thermometers.
   7. Flow control/balancing valves.
   8. Relief valves.
   9. Strainers.
   10. Hydrants.
   11. Backflow preventers.
   12. Water hammer arrestors.
   13. In-line circulator pumps.

B. Related Sections:
   1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
   2. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
   3. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
   4. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
   5. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Execution requirements for pipe expansion devices for placement by this section.
   6. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   3. ASME B31.9 - Building Services Piping.
   4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
   5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:
   1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
   2. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
   3. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
   4. ASSE 1052 – Performance Requirements for Hose Connection Backflow Preventers.
   5. ASSE 1061 – Performance Requirements for Removable and Non-Removable Push-Fit Fittings.

D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
5. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
6. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
7. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
8. ASTM E1 - Standard Specification for ASTM Thermometers.
9. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
10. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
11. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
12. ASTM F2023 – Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water.
13. ASTM F2389 – Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.

E. American Water Works Association:
1. AWWA C651 - Disinfecting Water Mains.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 67 - Butterfly Valves.
2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
3. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
4. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

G. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

H. NSF International:
1. NSF 14 – Plastics Piping System Components and Related Materials.
2. NSF 61 – Drinking Water System Components – Health Effects.
3. NSF 372 – Drinking Water Components – Lead Content.

I. Plumbing and Drainage Institute:
1. PDI WH201 - Water Hammer Arrester Standard.

J. U. S. Department of Housing and Urban Development:
1. FHA Bulletin 76 – Use of Materials Bulletin No. 76: Chlorinated Poly (Vinyl Chloride) CPVC and Polybutylene (PB) Hot and Cold-Water Distribution Piping.

1.3 SYSTEM DESCRIPTION

A. The Plumbing Contractor is responsible for items in this Section.

B. Water distribution system to be either copper or polypropylene-random (PP-R).

C. Pipe sizes indicated on drawings are based on ASTM B88 Type L copper tubing and ASTM A53/A53M, Schedule 40 steel pipe. For non-metallic pipe, contractor to verify nominal pipe size for equivalent pressure drop, flow rate, and velocity.

1.4 SUBMITTALS

A. Product Data:
   1. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
   2. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and equipment.

B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

C. Pressure Test Report: Submit verification of pressure test report. Include test type, testing pressure, and length of time.
   1. PP-R: Provide completed test report for Manufacturer's standard testing procedure.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. PB: Polybutylene systems (PB tubing together with recommended fittings) must by tested by the manufacturer at 150 psi and 210 °F for a period of not less than 48 hours by a qualified independent testing laboratory acceptable to the administrative authority.

C. CPVC: Chlorinated polyvinyl chloride (CPVC) pipe together with recommended fittings must by tested by the manufacturer at 150 psi and 210 °F for a period of not less than 48 hours by a qualified independent testing laboratory acceptable to the administrative authority.

D. PEX: Cross-linked polyethylene (PEX) tubing systems together with recommended fittings must by tested by the manufacturer at 150 psi and 210 °F for a period of not less than 30 days by a qualified independent testing laboratory acceptable to the administrative authority.

E. PP-R: Polypropylene (PP-R) pipe together with recommended fittings must by tested by the manufacturer at 540 psi hoop stress and 203 °F for a period of not less than 40 days by a qualified independent testing laboratory acceptable to the administrative authority.

F. Lead-free: All fittings, valves, fixtures, and accessories that contact potable water shall be lead-free compliant per NSF 61 and NSF 372.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
   1. PP-R Installer: Shall be factory-trained and carry proof of training during Inspections.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Polypropylene-Random Piping:
   1. Furnish ten-year manufacturer warranty for piping, fittings, and any incidental damage caused by material failure from manufacturer defect.
   2. Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or workmanship.
   3. Manufacturer's pressure testing procedure shall be followed to validate the warranty.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BELOW GRADE

A. Cross-linked Polyethylene (PEX) Tubing: ASTM F876, ASTM F877, NSF 14, NSF 61.
   1. Fittings: ASTM F1807, ASTM F1960, ASTM F2080, ASTM F2098-1, ASTM F2159, ASTM F877. No buried fittings allowed.
   2. When installed as a system in accordance with ASTM F877, the system tubing and fittings must be of the same manufacturer and marked as required.
   3. When not installed as a system, the fittings must be marked with ASTM F1807, ASTM F1960, ASTM F2080, ASCM F2098-1, or ASTM F215. The tubing must list the fitting and tubing standard.
   4. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.
      a. Flame Spread Classification: Less than 25.
      b. Smoke Development Rating: Less than 50.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing (2-inch diameter and smaller): ASTM B88, Type L, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: Solder, lead free, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 °F.
   3. Joints: Push-fit complying with NSF 61 and ASSE 1061. Crimping tool approved by Manufacturer and local Authority Having Jurisdiction. For pipe sizes 3/8 to 2 inches only.

B. Steel Pipe (2-½-inch diameter and larger): ASTM A53/A53M Schedule 40, galvanized, cut grooved ends. Note rolled grooved ends not permitted for galvanized steel pipe per Minnesota Plumbing Code Chapter 4714.
   1. Manufacturers:
      a. Victaulic.
      b. Anvil.
   2. Fittings: Grooved ends.
   3. Joints: Grooved mechanical couplings meeting ASTM F1476.
      a. Manufacturers:
         1) Victaulic.
         2) Anvil Gruvlok.
         3) Grinnell.

C. Polypropylene-Random (PP-R)
   1. Manufacturers:

a. Niron (Nupi Americas, Inc.).
b. Uponor.
2. Pipe: ASTM F2389, NSF 14, and NSF 61, three-layer extrusion, including fiber layer (faser).
3. Fittings: ASTM F2389, NSF 14, and NSF 61, PP-R.
4. Joints: Fusion-weld, including socket-fusion, elecrofusion, or butt-fusion.
5. Valves: ASTM F2389, NSF 14, and NSF 61, PP-R.
6. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.
   a. Flame Spread Classification: Less than 25.
   b. Smoke Development Rating: Less than 50.
7. UV Protection: Pipe to be exposed to directly sunlight for more than 30 days shall be provided with a Factory applied, UV-resistant coating, or alternative UV protection.
8. Integral Thermal and Vapor Barrier: ASTM E84, UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth.
   a. Up to 1 inch of required insulation: Factory-installed, thermal and vapor barrier insulation shall be provided.
   b. Over 1 inch of required insulation: Additional overlap of factory-installed, thermal and vapor barrier insulation shall be provided.
   c. Thick-wall, self-insulating fittings: Do not require an additional vapor barrier.
   d. See Section 22 07 00 for insulation requirements.

D. CPVC Pipe: ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M, NSF 14, FHA Bulletin 76, chlorinated polyvinyl chloride (CPVC) material.
1. Pipe Sizes 2-½-Inches to 6 Inches: Schedule 80.
2. Fittings: ASTM D2846/D2846Mor ASTM F441/F441M, CPVC.
3. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.
4. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.
   a. Flame Spread Classification: Less than 25.
   b. Smoke Development Rating: Less than 50.

E. Cross-linked Polyethylene (PEX) Tubing: ASTM F876, ASTM F877, NSF 14, NSF 61.
1. Fittings: ASTM F1807, ASTM F1960, ASTM F2080, ASTM F2098-1, ASTM F2159, ASTM F877. No buried fittings allowed.
2. When installed as a system in accordance with ASTM F877, the system tubing and fittings must be of the same manufacturer and marked as required.
3. When not installed as a system, the fittings must be marked with ASTM F1807, ASTM F1960, ASTM F2080, ASCM F2098-1, or ASTM F215. The tubing must list the fitting and tubing standard.
4. Smoke and Fire Ratings: Where plenum-rated piping is required, pipe shall be either pre-insulated or field insulated. Comply with ASTM E84.
   a. Flame Spread Classification: Less than 25.
   b. Smoke Development Rating: Less than 50.

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Copper Piping: Class 150, bronze unions with soldered.
2. Dielectric Connections: Dielectric union connections are NOT permitted.
3. CPVC Piping: CPVC.
4. PP-R Piping: PP-R.
5. PEX Piping: PEX.

B. Flanges for Pipe 2-½-inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.

2. PVC Piping: PVC flanges.
3. CPVC Piping: CPVC flanges.
4. PP-R Piping: PP-R flanges.
5. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.4 DIELECTRIC FITTINGS

A. Dielectric Waterway Connectors:
1. Manufacturers:
a. ClearFlow (Elstel Perfection)
2. Dissimilar metals shall be separated with a dielectric waterway connector
3. Material: Electro-zinc-plated steel casing, insert plastic lining, threaded ends.

2.5 BALL VALVES

A. Manufacturers:
1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc.
5. Stockham Valves & Fittings.

B. 2 inches and Smaller: MSS SP 110, one-piece bronze body, chrome plated brass ball, regular port, Teflon seats, blowout proof stem, solder or threaded ends with lever handle.
1. PEX Applications: Ends may be compatible with approve fitting system.

2.6 BUTTERFLY VALVES

A. Manufacturers:
1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc..
5. Stockham Valves & Fittings.
6. Victaulic Co.

B. 2-½-inches and Larger: MSS SP 67, Class 150.
1. Body: Cast or ductile iron, wafer lug or grooved ends, stainless steel stem, extended neck.
2. Disc: Nickel-plated ductile iron.
3. Seat: Resilient replaceable EPDM.
4. Handle and Operator: 10 position lever handle.

C. CPVC: 2 inches through 10 inches: 150 psi at 73 °F water temperature, maximum service temperature 210 °F, one- or two-piece body, ASTM D1784 CPVC, lug type flange facing, disc encapsulated with EPDM, stainless steel shaft, locking lever handle.

2.7 CHECK VALVES

A. Horizontal Swing Check Valves:
1. Manufacturers:
a. Crane Valve, North America.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO, Inc.

e. Stockham Valves & Fittings.

2. 2 inches and Smaller: MSS SP 80, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
3. 2-½-inches and Larger: MSS SP 71, cast iron body, bolted cap, bronze or cast iron disc, flanged ends.

2.8 PIPE HANGERS AND SUPPORTS

A. Refer to Section 22 05 29.

2.9 STEM TYPE THERMOMETERS

A. Manufacturers:
1. Ashcroft, Inc.
2. H. O. Trerice Company.
3. Weiss Instruments, Inc.

B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: Brass, ¾-inch NPT, Length as required for proper fluid sensing.
4. Accuracy: 2 percent.
5. Calibration: Both °F and °C.
6. Range:
a. Hot Water: 30 °F to 160 °F.
b. Cold Water: 0 °F to 100 °F.

C. Light-Powered Digital Thermometer: NEMA-4X, adjustable angle, LCD digits display, cast aluminum case with epoxy finish, cast aluminum adjustable joint with positive locking device.
1. Size: 7 inch scale.
2. Window: Clear Lexan.
3. Stem: Brass, 3/4 inch NPT, Length as required for proper fluid sensing.
4. Accuracy: 1 percent.
5. Units of Measure: Both °F and °C.
6. Range:
a. Hot Water: 30°F to 160°F.
b. Cold Water: 0°F to 100°F.

2.10 FLOW CONTROL/BALANCING VALVES - AUTOMATIC

A. Manufacturers:
1. Bell & Gossett (Xylem, Inc).
2. Danfoss.
3. Griswold Controls.
4. Taco, Inc.
5. Victaulic Co.
6. ThermOmegaTech.

B. Type: Flow control valve shall be manual balancing valve or automatic thermostatic recirculation valve (TRV), Circuit Solver Model CSUA by ThermOmegaTech, or equal.

C. Construction: Brass, bronze, or stainless-steel body with union and isolation ball valve on inlet and outlet, and temperature and pressure test plugs.

D. Calibration: When fully closed the TRV shall bypass a minimum of 0.1 GPM to maintain dynamic control of the hot water recirculation loop. Fully open TRV shall modulate towards a minimum closed position upon sensing a water temperature 3 °F or more above setpoint.

E. Automatic Control Mechanism: TRV shall regulate the flow of recirculated domestic hot water based on water temperature entering the valve regardless of system operating pressure. Thermal actuator shall be spring operated and self-cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits. Thermal actuator shall be rated for a minimum of 200,000 cycles. Thermal actuator shall be factory adjustable from 105 °F to 140 °F as required by project conditions.

F. Accessories: Valve shall include internal/integrated check valve.

2.11 RELIEF VALVES

A. Pressure Relief:
   1. ANSI Z21.22 certified, bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure Relief:
   1. ANSI Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 °F, capacity ASME certified and labeled.

2.12 HOSE BIBS

A. Manufacturers:
   1. Woodford Manufacturing Company.
   2. Zurn Wilkins (Zurn Industries, LLC).
   3. Leonard Valve Company.

B. (HB-1) Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with hand wheel.
   1. Backflow Preventers: Integral vacuum breaker in conformance with ASSE 1011.

2.13 HYDRANTS

A. Manufacturers:
   1. Woodford Manufacturing Company.
   2. Zurn Wilkins (Zurn Industries, LLC).
   3. Leonard Valve Company.

B. (H-1) Wall Hydrant: Automatic draining with anti-siphon vacuum breaker (ASSE 1011). ASSE Standard 1019-B approved. ¾" inlet and outlet. Hardened stainless steel operating stem and one-piece valve plunger to control both flow and drain functions. Exterior finish to be chrome plated. Loose tee key to be furnished with each hydrant.

2.14 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Apollo Valves (Aalberts Industries N.V.)
   2. Watts Water Technologies, Inc.
   3. Zurn Wilkins (Zurn Industries, LLC).

B. Reduced Pressure Backflow Preventers:
   1. Comply with ASSE 1013.
   2. Bronze body, with bronze internal parts and stainless-steel springs.
   3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

C. Double Check Valve Assemblies: Comply with ASSE 1015; Bronze body with corrosion resistant internal parts and stainless-steel springs; two independently operating check valves with intermediate atmospheric vent.

2.15 WATER HAMMER ARRESTORS

A. ASSE 1010; copper construction, piston type sized in accordance with PDI WH-201.

B. Pre-charged suitable for operation in temperature range 34 to 250 °F and maximum 150 psi working pressure.

2.16 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
   1. Bell & Gosset (Xylem)
   2. Grundfos Pumps Corp.
   3. Taco, Inc.
   4. Armstrong Fluid Technology.

B. Description: UL-listed and CSA approved, all bronze, suitable for 140˚F hot water system. Each pump shall be piped with circuit setter valve at the pump discharge, Teflon sealed ball valve at the suction side. Both valves shall be full sized as indicated on the drawings. All plumps to be flange-mounted for maintenance.

C. Performance: Refer to Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - THERMOMETERS AND GAGES

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-½-inches for installation of thermometer sockets. Allow clearance from insulation.

B. Provide instruments with scale ranges selected according to service with largest appropriate scale.

C. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.4 INSTALLATION - HANGERS AND SUPPORTS

A. Refer to Section 22 05 29

3.5 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 4 ft of cover.

C. Establish minimum separation from other services and sanitary sewer piping in accordance with applicable code.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Division 31.

F. Install pipe on prepared bedding.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Metallic Pipe: Install plastic ribbon tape continuously 18 inches above pipe line; coordinate with Division 31.

J. Non-Metallic Pipe: Install trace wire continuously over top of pipe; coordinate with Division 31.

K. Sleeve pipes passing through partitions, walls, floors, and foundations.

L. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Division 31.

3.6 INSTALLATION - ABOVE GROUND PIPING

A. For non-metallic pipe, verify nominal pipe size of equivalent pressure drop, flow rate, and velocity.

B. Install non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

E. Group piping whenever practical at common elevations.

F. Slope piping and arrange systems to drain at low points.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

I. Provide access where valves and fittings are not accessible.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.

M. Install domestic water piping in accordance with ASME B31.9.

N. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.
   1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
   2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.

O. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.

P. Install unions downstream of valves and at equipment or apparatus connections.

Q. Install valves with stems upright or horizontal, not inverted.

R. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

S. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

T. Install butterfly valves for throttling, bypass, or manual flow control services.

U. Provide check valves on discharge of water pumps.

V. Provide flow controls in water circulating systems as indicated on Drawings.

W. Install potable water protection devices on plumbing lines where contamination of domestic water may occur: on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

X. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

Y. Install water hammer arrestors complete with isolation valve.
   1. Water hammer arrestor and isolation valve shall be installed in accessible locations.
      a. Walls and hard ceilings are not considered accessible locations.
   2. Refer to Drawings for water hammer arrestor locations.

Z. Water supply connections to fixtures or equipment which have inlets below the spill line, must be provided with an approved backflow preventer.

AA. Valves shall be installed permitting the water supply to each individual fixture to be shut off without disrupting any other portion of the building. An accessible control valve shall be installed ahead of each slip joint connection at a plumbing fixture.

BB. Lead-free: all fittings, valves, and fixtures and accessories that contact potable water shall be lead-free compliant per NSF 61 and NSF 372.

CC. Where two separate handles control the hot and cold water, the left-handed control of the faucet where facing the fixture fitting outlet shall control the hot water. Faucets and diverter shall be connected to the water distribution system so that hot water corresponds to the left side of the fittings.

3.7 INSTALLATION – CPVC SYSTEMS

A. CPVC: Installation must be in accordance with IAPMO 20-98; however, this material may be air tested.

B. Install U-bend type pipe expansion loops every 50 feet. Minimum U-bend dimensions shall be 22 inches by 11 inches by 22 inches. Install guides per CPVC system manufacturer's installation requirements.

3.8 INSTALLATION – PEX SYSTEMS

A. PEX: Shall be installed by a factory-trained installer in accordance with the manufacturer's installation instructions.

3.9 INSTALLATION – PP-R SYSTEMS

A. PP-R: Shall be installed by a factory-trained installer in accordance with the manufacturer's installation instructions.

B. Install fittings and joints using socket-fusion, electrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

C. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.

D. Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F2389 and the manufacturer's specifications.

E. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

3.10 INSTALLATION - PUMPS

A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.

C. Install pumps on vibration isolators. Refer to Section 23 05 48.

D. Install flexible connectors at or near pumps where piping configuration does not absorb vibration. Refer to Section 23 21 16.

E. Provide line sized shut-off valve and pump suction fitting on pump suction, and line sized soft seat check valve, balancing valve, and shut-off valve on pump discharge. Refer to Section 23 21 16.

F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and larger.

G. Provide air cock and drain connection on horizontal pump casings.

H. Provide drains for bases and seals.

I. Check, align, and certify alignment of base mounted pumps prior to start-up.

J. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to .

K. Lubricate pumps before start-up.

3.11 INSTALLATION - SERVICE CONNECTIONS

A. Connect to existing water service inside of building.

3.12 FIELD QUALITY CONTROL

A. Test domestic water piping system in accordance with local Authority Having Jurisdiction.

B. PP-R: Test piping system in accordance with the Manufacturer's standard testing procedure.

3.13 CLEANING

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION

SECTION 22 13 00 – FACILITY SANITARY SEWERAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sanitary sewer piping below grade.
   2. Sanitary sewer piping above grade.
   3. Chemical resistant sewer piping.
   4. Pipe hangers and supports.
   5. Floor drains.
   6. Cleanouts.
   7. ICC-500 Vent Through Roof Assembly.
   8. Interceptors.
   9. Neutralization tank.

B. Related Sections:
   1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
   2. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
   3. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
   4. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
   5. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Execution requirements for pipe expansion devices for placement by this section.
   6. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A112.6.3 - Floor Drains and Trench Drains.
   2. ASME A112.14.1 - Backwater Valves.
   3. ASME A112.14.3 - Grease Interceptors.
   4. ASME A112.14.4 - Grease Removal Devices.
   5. ASME A112.36.2M - Cleanouts.

B. ASTM International:
   1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
   2. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
   3. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
   4. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   5. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
   6. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

C. Cast Iron Soil Pipe Institute:
   1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

A. Product Data:
   1. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
   2. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and clean-outs.

B. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BELOW GRADE

A. Cast Iron Pipe: CISPI 301, ASTM A888, hub-less, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gaskets and stainless-steel clamp-and-shield assemblies.

B. Plastic Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
   1. Fittings: PVC, ASTM D2665.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, ASTM A888, hub-less, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gaskets and stainless-steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2665, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.3 CHEMICAL RESISTANT SEWER PIPING

A. Manufacturers:
1. Spears Manufacturing Co.

B. CPVC Pipe: Type IV, ASTM F2618, ASTM D1784 Cell Classification of 23447, Schedule 40.
1. Compliance:
a. IAPMO IGC 210 and ICC-ES LC1007.
b. UL 723 or ASTM E 84 with flame spread of less than 25 and a smoke developed index of <50.
2. Fittings: ASTM D3311.
3. Joints: ASTM F493 solvent cement welding, specifically approved for corrosive chemicals.

2.4 PIPE HANGERS AND SUPPORTS

A. Refer to Section 22 05 29.

2.5 FLOOR DRAINS

A. Manufacturers:
1. Jay R. Smith Manufacturing Co.
2. Josam Co.
3. MIFAB, Inc.
4. Sioux Chief Manufacturing Co.
5. Watts Water Technologies Co.
6. Zurn Industries, LLC.

A. Floor Drain (FD-1): Floor drain shall have a Sch. 40 hub connection, which conforms to ASTM D2665 (PVC) or D2661 (ABS). Connection to drainage system shall be made with a solvent weld joint to ABS/PVC pipe. Strainer of floor drain shall fasten into female threaded brass inserts. Strainer shall be heel-proof and meet applicable load requirements for intended use. Designed in accordance with ASME A112.6.3-2001.

B. Floor Drain (FD-2): ASME A112.21.1; chemical- and corrosion-resistant, material must be part of Lab Waste System.

C. Trench Drains and Grates by Others. 4” floor drain in bottom of trench drain by plumber.

2.6 FLOOR SINKS

A. Manufacturers:
1. Jay R. Smith Manufacturing Co.
2. Josam Co.
3. MIFAB, Inc.
4. Sioux Chief Manufacturing Co.
5. Watts Water Technologies Co.
6. Zurn Industries, LLC.

B. Floor Sink (FS-1): ASME A112.6.7; Floor sink shall be molded from impact-modified PVC with Sch. 40 hub connection which conforms to ASTM D2665. Floor sink shall show no significant distortion at water temperatures up to 180°F. Strainer shall be heel-proof and shall meet all applicable load requirements for intended use. Floor sink shall be designed with a concrete anchor flange for solid installations. Sump area shall have smooth, pitched inner surfaces for quick and complete drainage.

C. Floor Sink (FS-2): Square cast iron can wash drain with acid resisting interior, double drainage flange with weepholes, bottom outlet, removable sediment bucket, bronze spray nozzle assembly and nikaloy rim and light-duty nikaloy secured grate.

2.7 CLEANOUTS

1. Jay R. Smith Manufacturing Co.
2. Josam Co.
3. MIFAB, Inc.
4. Sioux Chief Manufacturing Co.
5. Watts Water Technologies Co.
6. Zurn Industries, LLC.

B. Exterior Surfaced Areas: Epoxy coated cast iron access housing with anchor flanges and extra heavy-duty ductile iron cover.

C. Exterior Unsurfaced Areas (Yard Cleanout): PVC threaded tee.

D. Interior Finished Floor Areas: Epoxy coated cast iron floor cleanout with 5-inch round adjustable gasketed nickel bronze top, stainless steel carpet marker, removable gas tight gasketed brass cleanout plug, and no hub outlet.

E. Interior Finished Wall Areas: Epoxy coated cast iron floor cleanout with 5-inch round adjustable gasketed heavy-duty stainless-steel top, removable gas tight gasketed brass plug, and no hub outlet.

F. Interior Finished Floor Areas: epoxy coated cast iron floor cleanout with 5-inch x 5-inch square adjustable gasketed heavy-duty stainless-steel top, removable gas tight gasketed brass plug, and no hub outlet.

G. Interior Finished Wall Areas: wall cleanout with two-piece expandable cleanout plug, stainless steel access cover, and vandal proof stainless steel screw.

H. Interior Unfinished Accessible Areas: Cast iron stack cleanout with threaded brass raised head cleanout plug, and no hub connections.

2.8 ICC-500 VENT THROUGH ROOF ASSEMBLY

A. Manufacturers:
1. Roof Penetration Housings, LLC (Basis of Design: Cyclone Vent Through Roof – CVTR).
2. MIFAB, Inc. (provide ICC-500 compliant equivalent).
3. Jay R. Smith Mfg. Co (provide ICC-500 compliant equivalent).

B. (Type VTR) ICC-500 Vent Through Roof Assembly:
1. Basis of Design Product: Cyclone® Vent Through Roof (CVTR) by Roof Penetration Housings, LLC.
2. General:
   a. Factory-fabricated, impact-resistant roof penetration assembly for plumbing vent piping serving ICC-500 storm shelters or safe rooms.
   b. Assembly shall provide protection against wind, wind-borne debris, and water intrusion while maintaining required vent functionality.
3. Standards and Performance:
   a. Third-party tested and labeled to comply with International Code Council ICC-500 (latest adopted edition).
   b. Comply with Federal Emergency Management Agency P-361 guidelines for safe rooms.
   c. Capable of withstanding wind speeds up to 250 mph, including missile impact testing.
   d. Provide two-point deflection design such that wind-borne debris impacts at least two surfaces prior to entering protected space.
4. Construction:
   a. Housing fabricated from minimum 3/16-inch thick carbon steel or schedule 40 steel components.
   b. Fully welded construction with reinforced internal geometry to resist impact and deformation.
   c. Provide integral hood or deflection chamber to prevent direct line-of-sight entry into protected space.

5. Configuration:
    a. Vertical vent-through-roof configuration for plumbing vent piping.
    b. Provide internal pipe connection with no-hub coupling (by contractor) sized 2-inch through 6-inch as scheduled.
    c. Assembly shall maintain required vent cross-sectional area without obstruction.
6. Roof Integration:
    a. Coordinate with roofing system manufacturer for flashing, curb, and waterproofing.
    b. Provide units suitable for:
        1. Poured-in-place concrete roofs (-PP).
        2. Precast concrete roofs (-PC).
            a.) Unit shall be custom fabricated to match roof thickness and parapet height as required.
7. Finish:
    a. Manufacturer's standard industrial coating system for corrosion resistance.
    b. Finish suitable for exterior exposure and compatible with roofing system.
8. Accessories:
    a. Provide compatible curb, flashing flange, and anchorage system.
    b. Provide internal sealing system to maintain watertight and airtight penetration.
    c. Provide labeling indicating compliance with ICC-500 and FEMA P-361.
9. Installation Requirements:
    a. Install in strict accordance with manufacturer's instructions and tested assembly.
    b. Anchor to structure to resist design wind and impact loads.
    c. Maintain continuity of air barrier, vapor barrier, and roofing system.
    d. Coordinate penetration with structural and architectural drawings to maintain storm shelter envelope integrity.
10. Security/Safety Requirements:
    a. Assembly shall prevent direct projectile entry into occupied space.
    b. No straight-through openings permitted.
    c. Maintain occupant protection consistent with ICC-500 storm shelter envelope requirements.

2.9 GREASE INTERCEPTORS

A. Gravity grease interceptors must be approved by the administrative authority, serve only fixtures discharging greasy waste, and meet Section 1014.3. No food waste disposer or dishwasher may discharge to the grease interceptor unless specifically permitted by the administrative authority. The installation must include:
    1. The interceptor must comply with IAMPO Z1001 and be so marked on a permanent product identification label. The interceptor covers must be gasketed and secured to prevent access of unauthorized individuals.
    2. The minimum interceptor volume is determined by Table 1014.3.6.
    3. The design must preclude becoming air-bound and the interceptor must be properly vented.
    4. Exterior installations must be protected from freezing and provided with buoyancy protection as required by the manufacturer's installation instructions.
    5. The interceptor must be located as to be readily accessible for the required maintenance equipment.

B. Hydromechanical grease interceptors may only serve fixtures discharging greasy waste and must meet Section 1014.2. No food waste disposer may be connected unless the interceptor is designed to receive food waste. Dishwasher connections are prohibited (See Section 1014.1.3). The installation must include:
    1. The interceptor must comply with ASME A112.14.3, ASME A112.14.4, CSA B481, PDI G-101, or PDI G-102 and be so marked on a permanent identification label.

2. The interceptor and flow control must be readily accessible. Vents serving external flow controls must connect to the sanitary vent system.
3. The interceptor must be maintained in efficient operating condition.

2.10 SEDIMENT INTERCEPTORS

A. Manufacturers:
1. Schier Products.
2. Zurn Industries, LLC.
3. Striem.

B. Basis of Design: Striem Sidekick™ side access solids interceptor.

C. Striem solids interceptor model SIDEKICK shall be lifetime guaranteed and made in the USA. Interceptor shall be constructed of an infection molded PVC housing and polycarbonate perforated basket. Interceptor shall be certified to IAPMO/ANSI/CAN Z1167 and carry a UPC listing. Interceptor is manufactured for above-grade installation. Basket shall provide the ability for side-access maintenance and shall be clear to allow visibility into unit.
1. 1-1/2” or 2” PVC socket inlet and outlet connections (adapters included).
2. Under-sink solids interceptor.
3. PVC housing, polycarbonate perforated basket with o-ring to provide water-tight seal.
4. Top inlet and three outlet options (plugs included for unused outlets.
5. Max. flow rate: 23 GPM.
6. Solids capacity: 0.17 gallons.
7. Unit weight: 3.2 lbs.
8. Maximum operating temperature: 140°F continuous.
9. For gravity drainage applications only.

2.11 NEUTRALIZATION TANK

A. Manufactures:
1. Schier Products.
2. Zurn Industries, LLC.
3. Striem.

B. Basis of Design: Striem LB-275, Lab Basin™ Polyethylene Neutralization Tank.

C. Striem neutralization tank model LB-275 shall be lifetime guaranteed and made in the USA. Tank shall be constructed of polyethylene. Tank shall be manufactured for above- or below-grade installation. Field-adjustable riser system is available as an option to bring manhole covers to grade. Tank liquid holding capacity shall be 250 gallons. Covers shall be H20 rated pickable cast iron.
1. 4” Plain End inlet/outlet, 2”Plain End vents, C24-HP covers standard.
2. Liquid holding capacity: 250 Gallons.
3. Unit weight w/standard covers: 345 lbs.
4. Maximum operating temperature 140°F continuous.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Refer to Section 22 05 29.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify existing piping system connection size, location, and invert is as indicated on Drawings.

B. Establish invert elevations, sloped for drainage to ¼-inch per foot minimum of buried piping with not less than 2 ft of cover. Maintain gradients.

C. Establish minimum separation of drainage piping from other services piping in accordance with local code.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Division 31.

F. Install pipe to elevation required to maintain slope.

G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth.

H. Install pipe on prepared bedding.

I. Route pipe in straight line.

J. Install trace wire continuous buried 6 inches below finish grade, above pipeline; coordinate with Division 31.

K. All horizontal branch drains shall be uniformly pitched at ¼-inch per foot.

L. The building sewer must be installed with a uniform slope of at least ¼-inch per foot. Where municipal sewer depth, structural features, or building arrangement preclude this slope, a slope of 1/8-inch per foot minimum may be utilized if approved by the authority having jurisdiction.

M. All sinks, except for lavatories and private-use bar sinks, must be provided with 2-inch minimum vertical fixture drains. Laundry tubs, domestic clothes washers, and urinals also require 2-inch minimum vertical drains.

N. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Division 31.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
   4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
   5. Do not use wheeled or tracked vehicles for tamping.

3.5 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to ¼-inch per foot minimum. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom. Do not spread piping, conserve space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

K. Provide access where valves and fittings are not accessible.

L. Install piping penetrating roofed areas to maintain integrity of roof assembly.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

N. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.

O. Install bell and spigot pipe with bell end upstream.

P. Sleeve pipes passing through partitions, walls, and floors.
   1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
   2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.

Q. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.

R. Support cast iron drainage piping at every joint.

S. Installation standards for ABS and PVC allow the use of offsets, expansion joints, or restraints provided conditions of proper support and movement are met. Accordingly, aboveground horizontal and vertical plastic piping must be installed with restraint fittings or a minimum 24-inch, 45-degree offset every 30 feet.

3.6 INSTALLATION – ACID NEUTRALIZATION TANK

A. If the acid neutralization tank has an inverted pipe on the tank outlet, then the vent serving the tank shall connect to the acid vent system. Since there will be a water seal on the tank outlet, you must vent the drainage branch downstream of the tank. This vent shall connect to the conventional vent system and not the acid vent system.

B. If the acid neutralization tank has an inverted pipe on the inlet and no inverted pipe on the outlet, then the vent serving the tank shall connect to the conventional vent system and the acid vent system.

C. Fixture vents must rise within 45 degrees from the vertical at least 6-inches above the flood level before offsetting horizontally or connecting to a branch vent (see Minnesota Rules, Chapter 4714). This shall apply to the acid neutralization tank.

D. Verify that no vent for a fixture receiving chemical waste connects to any vent for other services, except where permitted by the administrative authority (see Minnesota Rules, Chapter 4714).

3.7 FIELD QUALITY CONTROL

A. Cast iron soil pipe and fittings must be marked with their country of origin, the collective trademark of the Cast Iron Soil Pipe Institute, and identification of the original manufacturer in addition to markings required by reference standards (See Minnesota Rules, Chapter 4714, Section 701.0). They shall also be listed by NSF International.

B. Test sanitary waste and vent piping system in accordance with local Authority Having Jurisdiction.

END OF SECTION

SECTION 22 1400 – FACILITY STORM DRAINAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Storm water piping below grade.
   2. Storm water piping above grade.
   3. Pipe hangers and supports.
   4. Roof drains.
   5. ICC-500 Roof Drains and Overflow Drains.
   6. Downspout Nozzles.
   7. Cleanouts.

B. Related Sections:
   1. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
   2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
   3. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
   4. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
   5. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
   6. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Execution requirements for pipe expansion devices for placement by this section.
   7. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A112.6.4 - Roof, Deck, and Balcony Drains.
   2. ASME A112.36.2M - Cleanouts.

B. ASTM International:
   1. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   2. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
   3. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
   4. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. Cast Iron Soil Pipe Institute:
   1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

A. Product Data:
   1. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and clean-outs.

B. Operation and Maintenance Data: Submit spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: Neoprene gaskets and stainless-steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2665 PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 PIPE HANGERS AND SUPPORTS

A. Refer to Section 22 05 29.

2.3 ROOF DRAINS

A. Manufacturers:

1. Jay R. Smith Manufacturing Co.
2. Mifab, Inc.
3. Sioux Chief Manufacturing Co.
4. Watts Water Technologies Co.
5. Zurn Industries, LLC.

B. (RD-1) Roof Drain:
1. Assembly: ASME A112.21.2M.
2. Body: Lacquered or galvanized cast iron with sump.
3. Strainer: Removable polyethylene or cast metal dome.
4. Accessories: Coordinate with roofing type, refer to Division 07:
    a. Membrane flange and membrane clamp with integral gravel stop.
    b. Adjustable under deck clamp.
    c. Roof sump receiver.
    d. Waterproofing flange.
    e. Controlled flow weir.
    f. Leveling frame.
    g. Adjustable extension sleeve for roof insulation.
    h. Perforated or slotted ballast guard extension for inverted roof.
    i. Perforated stainless steel ballast guard extension.

C. (ORD-1) Overflow Roof Drain:
1. Same as RD-1 except as noted.
2. Pipe extended to 2 inches above flood elevation.

2.4 ICC-500 ROOF DRAINS AND OVERFLOW DRAINS

A. Manufacturers:
1. Roof Penetration Housing, LLC (Basis of Design: Cyclone Roof Drain – CRD; Overflow Roof Drain – COFRD).
2. Jay R. Smith Manufacturing Co. (provide 1CC-500 compliant equivalent).
3. Mifab, Inc. (provide 1CC-500 compliant equivalent).
4. Zurn Industries, LLC. (provide 1CC-500 compliant equivalent).

B. (Type RD) ICC-500 Roof Drain:
1. Basis of Design Product: Cyclone® Roof Drain (CRD) by Roof Penetration Housings, LLC.
2. General:
    a. Factory-fabricated roof drain assembly designed for use in ICC-500 storm shelters and safe rooms.
    b. Assembly shall maintain required roof drainage performance while providing impact and wind resistance for protected spaces.
3. Standards and Performance:
    a. Third-party tested and labeled to comply with ICC-500 (latest adopted edition) and FEMA P-361.
    b. Capable of resisting wind speeds up to 250 mph, including missile impact.
    c. Designed with two-point deflection to prevent direct projectile entry into protected space.
    d. Drain shall meet ANSI standards for size and ASPE flow rate requirements.
4. Construction:

a. Fabricated from minimum 3/16-inch carbon steel or Schedule 40 steel components.
b. Fully welded, reinforced construction suitable for high-impact environments.
c. Provided dome-shaped inlet to reduce impact forces transmitted to drain body.
d. Provide integral housing or geometry that eliminates direct line-of-sight into storm shelter.

5. Configuration:
   a. Suitable for flat or low-slope roof applications.
   b. Sizes: 4-inch, 6-inch, 8-inch, and 10-inch nominal outlet connections, as indicated.
   c. Provide no-hub outlet connection compatible with plumbing system.
6. Roof Integration:
   a. Provide flashing flange, clamping ring, and gravel stop compatible with roofing system.
   b. Coordinate with roofing manufacturer for warranty compliance.
   c. Provide configurations suitable for:
      1. Poured-in-place concrete roofs (PP).
      2. Precast concrete roofs (PC).
7. Finish:
   a. Manufacturer's standard industrial coating for corrosion resistance and exterior exposure.
8. Accessories:
   a. Provide dome strainer, clamping collar, and flashing components.
   b. Provide manufacturer's standard sealing system to ensure watertight installation.
   c. Provide labeling indicating ICC-500 and FEMA P-361 compliance.
9. Installation Requirements:
   a. Install in strict accordance with manufacturer's tested assembly.
   b. Anchor to structure to resist design wind and impact loads.
   c. Maintain continuity of roofing, air barrier, and storm shelter envelope.
   d. Coordinate with structural and architectural documents to maintain shelter integrity.

C. (Type ORD) ICC-500 Overflow Roof Drain:
1. Basis of Design Product: Cyclone® Overflow Roof Drain (COFRD) by Roof Penetration Housings, LLC.
2. General:
   a. Provide overflow drainage system where required to prevent structural overloading of roof system.
   b. Overflow drains shall be fully compliant with ICC-500 storm shelter requirements.
3. Standards and Performance:
   a. Third-party tested to ICC-500 and FEMA P-361 for wind and missile impact resistance.
   b. Meet ASPE / IAPMO / ANSI Z1034 flow rate standards.
   c. Designed with two-point deflection geometry for impact resistance.
4. Construction:
   a. Fabricated from minimum 3/16-inch carbon steel or Schedule 40 steel with industrial coating.
   b. Dome or hooded configuration to protect opening while allowing overflow discharge.

c. Fully welded, heavy-duty construction resistant to deformation and tampering.

5. Configuration:
   a. Sized to match primary drainage system and as indicated on drawings.
   b. Provide elevation above primary drain in accordance with plumbing code requirements.
   c. Available in sizes 4-inch and 6-inch minimum, or as required by design.
6. Roof Integration:
   a. Coordinate flashing, waterproofing, and attachment with roofing system.
   b. Provide configurations suitable for poured-in-place or precast construction.
7. Accessories:
   a. Provide strainers, flashing clamps, and connection fittings.
   b. Provide labeling indicating compliance with ICC-500 and FEMA P-361.
8. Installation Requirements:
   a. Install per manufacturer's instructions and tested configuration.
   b. Ensure overflow system is independent of primary system where required by code.
   c. Maintain integrity of storm shelter envelope.

D. Security/Storm Shelter Requirements (All Drains):
1. No direct line-of-sight openings into occupied shelter space.
2. All assemblies shall prevent penetration of wind-borne debris.
3. Units shall maintain both **drainage performance and occupant protection** during extreme wind events.
4. Damaged units following impact events shall be replaced to maintain compliance.

2.5 DOWNSPOUT NOZZLES

A. Manufacturers:
1. Jay R. Smith Manufacturing Co.
2. Mifab, Inc.
3. Sioux Chief Manufacturing Co.
4. Watts Water Technologies Co.
5. Zurn Industries, LLC.

B. Downspout Nozzles (DS-1): Cast bronze downspout nozzle, loose wall flange and no-hub inlet connection.

2.6 CLEANOUTS

A. Refer to Section 22 13 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Refer to Section 22 05 29

3.4 INSTALLATION - BURIED PIPING SYSTEMS

A. Install per Section 22 13 00.

3.5 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Install per Section 22 13 00.

3.6 FIELD QUALITY CONTROL

A. Cast iron pipe and fittings must be marked with their country of origin, the collective trademark of the Cast Iron Soil Pipe Institute, and identification of the original manufacturer in addition to markings required by reference standards (See Minnesota Rules, Chapter 4714, Section 701.0). They shall also be listed by NSF International.

B. Test storm drainage piping system in accordance with local Authority Having Jurisdiction.

END OF SECTION

SECTION 22 33 00 – ELECTRIC DOMESTIC WATER HEATERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commercial electric water heaters.

B. Related Sections:
   1. Section 22 11 00 - Facility Water Distribution: Supply connections to domestic water heaters.
   2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. American Society of Mechanical Engineers:
   1. ASME PTC 25 - Pressure Relief Devices.
   2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.

C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.

D. Manufacturer's Installation Instructions: Submit mounting and support requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.5 QUALITY ASSURANCE

A. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1.

B. Perform Work in accordance with state code and standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept water heaters on site in original labeled cartons. Inspect for damage.

B. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 COMMERCIAL ELECTRIC WATER HEATERS

A. Furnish materials in accordance with state codes and standards.

B. Type: Factory-assembled and wired, electric.

C. Capacity:
   1. See drawings.

D. Description (WH-1):
   1. Point-Of-Use electric water heater.
   2. Manufacturers:
      a. Basis-of-Design: Hubbell Model CE110
      b. Eemax.
      c. Prior-approved equal.
   3. The pressure section shall be constructed of stainless steel and rated for 150 psi working pressure. The water heater is designed for installation directly under the plumbing fixture without occupying any floor space. The tank is to be jacketed with stainless steel and insulated with fiberglass blanket insulation. The immersion copper sheathed heating element shall be rated at 1000 Watts, 120 Volt, single Phase, 60 Hz power and have a maximum rating of 50 Watts per square inch to ensure heating element longevity. The immersion heater shall be controlled by an adjustable 110 - 170°F thermostat and will provide hot water at the stated GPH recovery rate regardless of the short-term flow rate at the point-of-use fixture. The water heater shall not require the removal or replacement of the original faucet mounted aerator or the installation of a flow restricting device, and the heater hall be operable from 0-150 psi working pressure. The heater shall include an over-temperature manual reset Hi-Limit designed to disconnect all conductors to the heating element in the event of an over-temperature condition. Water heaters relying solely on an automatic resetting Hi-Limit device will not be acceptable. Two (2) wall brackets shall be supplied for wall mounting. An ASME/CSA rated combination temperature and pressure safety relief valve set at 150 psi and 210°F shall be factory supplied for in the field installation.

E. Description (WH-2):
   1. Point-Of-Use electric water heater.
   2. Manufacturers:
      a. Basis-of-Design: Hubbell Model E06.
      b. Eemax.
      c. Prior-approved equal.
   3. The entire unit is to be complete with all operating controls and require only plumbing and electrical service connections. The tank shall be all welded steel commercial construction designed for 150 psi working pressure and contain 6 gallons of storage. The tank is to be lined with seamless Hydrastone cement to a minimum thickness of ½" on 100% of all interior tank surfaces and does not require any type of anodic protection. The tank shall be designed and fabricated with non-ferrous copper-silicon threaded tappings and non-ferrous inlet and outlet piping for maximum corrosion resistance. Steel tank tappings will not be acceptable. The entire tank is to be insulated with a minimum of 2" thick polyurethane foam insulation that exceeds the latest ASHRAE standard for stand-by heat loss. The complete heater shall be supplied with high impact colorized composite protective jacket which cannot rust or corrode and does not require painting. The unit shall bear the UL listing mark certifying the entire water heater.

The cold water inlet shall be ¾" female NPT and include a non-corrosive strata-flow diffuser which prevents incoming cold water from mixing too rapidly with hot water in the tank. A ¾" hose connection drain is supplied. The hot water outlet shall be ¾" male NPT and shall include a factory installed built-in heat trap to prevent water from radiating through the piping during stand-by periods. A separate ¾" female NPT tappings is to be provided for relief valve installation. An ASME/AGA rated automatic reseating combination temperature and pressure safety relief valve set at 150 psi and 210-degree F shall be factory supplied.

F. Performance:
   1. See drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Connect domestic cold water piping to supply and return water heater connections.

C. Install the following piping accessories. Refer to Section 22 11 00.
   1. On supply:
      a. Thermometer well and thermometer.
      b. Strainer.
   2. On return:
      a. Shutoff valve.

D. Install water heater trim and accessories furnished loose for field mounting.

E. Install Work in accordance with state codes and standards.

END OF SECTION

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SECTION 22 40 00 – PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water closets.
   2. Lavatories.
   3. Sinks.
   4. Showers.
   5. Drinking fountains.
   6. Service sinks.
   7. Safety fixtures.
   8. Valve Boxes.

B. Related Sections:
   1. Section 22 11 00 - Facility Water Distribution: Supply connections to plumbing fixtures.
   2. Section 22 13 00 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ANSI Z124.1 - Plastic Bathtub Units.
   3. ANSI Z124.2 - Plastic Shower Units.
   4. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

B. Air-Conditioning and Refrigeration Institute:
   1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:
   1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
   2. ASME A112.18.1 - Plumbing Supply Fittings.
   3. ASME A112.19.1 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures.
   4. ASME A112.19.2 - Ceramic Plumbing Fixtures.
   5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures.
   6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
   7. ASME A112.19.5 – Flush Valves and Spuds for Water Closets, Urinals, and Tanks.

D. NSF International:
   1. NSF 61 – Drinking Water System Components – Health Effects.
   2. NSF 372 – Drinking Water Components – Lead Content.

1.3 SUBMITTALS

A. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit fixture, trim, exploded view, and replacement parts lists.

1.5 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Provide products requiring electrical connections listed and classified by testing firm acceptable to Authority Having Jurisdiction as suitable for purpose specified and indicated.

C. Lead-free: All fittings, valves, fixtures, and accessories that contact potable water shall be lead-free compliant per NSF 61 and NSF 372.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. (WC-1) Water Closet, Wall Hung, Flush Valve, ADA Compliant (STORM SHELTER).
   1. Bowl:
      a. Manufacturers:
         1) American Standard Brands.
         2) Kohler Co.
         3) Mansfield Plumbing.
         4) PROFLO.
         5) TOTO USA.
      b. Mounting: Wall mount. Refer to wall mount carrier.
      c. Performance: 1.6 GPF.
      d. Color: White.
      e. Compliance:
         1) ASME A112.19.2.
         2) ADA compliant.
   2. Flush Valve, Senor Operated:
      a. Manufacturers:
         1) Sloan Valve Co.
         2) Zurn Industries, LLC.
      b. Performance:
         1) Flow: 1.6 GPF.
         2) Power: Battery.
         3) True Mechanical Override Flush Button.
      c. Compliance:
         1) ASME A112.19.2.
         2) ADA compliant.
   3. Seat:
      a. Manufacturers:
         1) Beneke Magnolia (Sanderson).
         2) Church (Bemis Manufacturing Co.).

3) Olsonite (Bemis Manufacturing Co.).
b. Compliance:
1) ANSI Z124.5, Class: Commercial Heavy Duty.
2) Elongated, open front, less cover.
4. Wall Mounted Carrier:
a. Construction: Commercial grade, extra heavy-duty 750 lbs. carrier of approved style. Verify with general contractor for type of wall construction and space prior to ordering carriers.
b. Compliance: ASME A112.6.1M and ADA compliant.

B. (WC-2) Water Closet, Wall Hung, Flush Valve:
1. Same as WC-1 except as noted.
2. Bowl:
a. Compliance: ADA compliance not required.
3. Flush Valve, Sensor Operated:
a. Compliance: ADA compliance not required.

C. (WC-3) Water Closet, Wall Hung, Flush Valve, ADA Compliant.
1. Bowl:
a. Manufacturers:
1) American Standard Brands.
2) Kohler Co.
3) Mansfield Plumbing.
4) PROFLO.
5) TOTO USA.
b. Mounting: Wall mount. Refer to wall mount carrier.
c. Performance: 1.6 GPF.
d. Color: White.
e. Compliance:
1) ASME A112.19.2.
2) ADA compliant.
2. Flush Valve, Senor Operated:
a. Manufacturers:
1) Sloan Valve Co.
2) Zurn Industries, LLC.
b. Performance:
1) Flow: 1.6 GPF.
2) Power: Hardwired.
3) True Mechanical Override Flush Button.
c. Compliance:
1) ASME A112.19.2.
2) ADA compliant.
3. Seat:
a. Manufacturers:
1) Beneke Magnolia (Sanderson).
2) Church (Bemis Manufacturing Co.).
3) Olsonite (Bemis Manufacturing Co.).
b. Compliance:
1) ANSI Z124.5, Class: Commercial Heavy Duty.

2) Elongated, open front, less cover.

4. Wall Mounted Carrier:
   a. Construction: Commercial grade, extra heavy-duty 750 lbs. carrier of approved style. Verify with general contractor for type of wall construction and space prior to ordering carriers.
   b. Compliance: ASME A112.6.1M and ADA compliant.

D. (WC-4) Water Closet, Wall Hung, Flush Valve:
   1. Same as WC-3 except as noted.
   2. Bowl:
      a. Compliance: ADA compliance not required.
   3. Flush Valve, Sensor Operated:
      a. Compliance: ADA compliance not required.

2.2 TANK TYPE WATER CLOSETS

A. (WC-5) Water Closet, Tank Type, ADA Compliant.
   1. Bowl:
      a. Manufacturers:
         1) American Standard Brands.
         2) Kohler Co.
         3) Mansfield Plumbing.
         4) PROFLO.
         5) TOTO USA.
      b. Mounting: Floor mount.
      c. Performance: FOR DEMONSTATRATION ONLY. NO ACTIVE SANITARY SEWER AND WATER.
      d. Color: White.
      e. Compliance:
         1) ASME A112.19.2.
         2) ADA compliant.
   2. Seat:
      a. Manufacturers:
         1) Beneke Magnolia (Sanderson).
         2) Church (Bemis Manufacturing Co.).
         3) Olsonite (Bemis Manufacturing Co.).
      b. Compliance:
         1) ANSI Z124.5, Class: Commercial Heavy Duty.
         2) Elongated, open front, less cover.

2.3 LAVATORIES

A. (L-1) Lavatory, Wall Hung, ADA Compliant (STORM SHELTER).
   1. Sink:
      a. Manufacturers:
         1) American Standard Brands.
         2) Kohler Co.
         3) Mansfield Plumbing.
         4) PROFLO.
      b. Mounting: Wall-mounted with hangers.

c. Color: White.
d. Compliance:
1) ASME A112.19.2.
2) ADA compliant.

2. Faucet:
a. Manufacturers:
1) Bradley Corp.
2) Chicago Faucets.
3) Delta Faucet Co.
4) Elkay Manufacturing Co. (Dayton).
5) Moen, Inc.
6) Sloan Valve Company.
b. Performance:
1) Flow: 0.5 GPM.
2) Power: Battery Power Supply.
c. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.

3. Thermostatic Mixing Valve, Point of Use:
a. Basis of Design: Leonard, Model: 170A-LF.
b. Manufacturers:
1) Lawler Manufacturing Company, Inc.
2) Leonard Valve Company.
3) Zurn Industries, LLC.
c. Compliance:
1) ASSE 1070.
2) Low-lead compliant.

4. Accessories:
a. Metal grid strainer.
b. Wheel handle angle stops.
c. Rigid supplies.
d. Trap and waste insulated and offset to meet ADA compliance.
1) Manufacturers:
a) Truebro (IPS Corp.).
b) Plumberex Specialty Products Co.

5. Wall Mounted Carrier:
a. Hanger to be included with sink.

B. (L-2) Lavatory, Wall Hung, ADA Compliant (STORM SHELTER).
1. Same as L-1 except as noted.
2. Bowl:
a. Compliance: ADA compliance not required.
3. Faucet, Sensor Operated:
a. Compliance: ADA compliance not required.

C. (L-3) Lavatory, Wall Hung, ADA Compliant.
1. Sink:

a. Manufacturers:
1) American Standard Brands.
2) Kohler Co.
3) Mansfield Plumbing.
4) PROFLO.
b. Mounting: Wall-mounted with hangers.
c. Color: White.
d. Compliance:
1) ASME A112.19.2.
2) ADA compliant.

2. Faucet:
a. Manufacturers:
1) Bradley Corp.
2) Chicago Faucets.
3) Delta Faucet Co.
4) Elkay Manufacturing Co. (Dayton).
5) Moen, Inc.
6) Sloan Valve Company.
b. Performance:
1) Flow: 0.5 GPM.
2) Power: Hardwired.
c. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.

3. Thermostatic Mixing Valve, Point of Use:
a. Basis of Design: Leonard, Model: 170A-LF.
b. Manufacturers:
1) Lawler Manufacturing Company, Inc.
2) Leonard Valve Company.
3) Zurn Industries, LLC.
c. Compliance:
1) ASSE 1070.
2) Low-lead compliant.

4. Accessories:
a. Wheel handle angle stops.
b. Rigid supplies.
c. Trap and waste insulated and offset to meet ADA compliance.
1) Manufacturers:
a) Truebro (IPS Corp.).
b) Plumberex Specialty Products Co.

5. Wall Mounted Carrier:
a. Hanger to be included with sink.

D. (L-4) Lavatory, Wall Hung, ADA Compliant.
1. Sink:
a. Manufacturers:

1) American Standard Brands.
2) Kohler Co.
3) Mansfield Plumbing.
4) PROFLO.

b. Mounting: Wall-mounted with hangers.
c. Color: White.
d. Compliance:
1) ASME A112.19.2.
2) ADA compliant.

2. Faucet, Two Handle Deck Mount, ADA compliant:
a. Manufacturers:
1) Bradley Corp.
2) Chicago Faucets.
3) Delta Faucet Co.
4) Elkay Manufacturing Co. (Dayton).
5) Moen, Inc.
6) Sloan Valve Company.

b. Performance:
1) FOR DEMONSTATRATION ONLY. NO ACTIVE SANITARY SEWER AND WATER.

c. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.

3. Accessories:
a. Metal Grid Strainer.
b. Trap and waste insulated and offset to meet ADA compliance.
1) Manufacturers:
a) Truebro (IPS Corp.).
b) Plumberex Specialty Products Co.

4. Wall Mounted Carrier:
a. Hanger to be included with sink.

2.4 SINKS

A. (S-1) Sink, Three Station Wash Sink 6’-0”, ADA compliant.
1. Sink:
a. Manufacturers:
1) American Standard Brands.
2) Elkay Manufacturing Co.
3) Kohler Co.
4) Mansfield Plumbing.
5) PROFLO.
6) Advance Tabco.

b. Mount: Wall mount.
c. Finish: All TIG welded. Welded areas blended to match adjacent surfaces and to a satin finish.
d. Construction:
1) 16-gauge, type 304 stainless steel.

2) 1-5/8” tubular 304 stainless steel supports.
3) 8 ½-inch high backsplash.
4) One stainless steel “Z” bracket supplied each unit.
5) One K-6 3 ½-inch rear basket drain.
6) Tubular stainless steel legs with flanged feet.
7) Side & rear adjustable cross-bracing with leg clamps.
8) “ADA-F” Series Includes K-161-LU 8 ½-inch gooseneck faucets with wrist handles.

e. Dimensions:
1) Bowl Depth: 5 inches.
2) Faucet Holes: 8” O.C. faucet holes punched in splash at each station.
3) Overall: 72-inch length, 19 1/2-inch width.

f. Compliance:
1) ASME A112.19.3.
2) ADA compliant.

2. Trim:
a. Included with “ADA-F” Series.
b. Performance:
1) Flow: 2.2 GPM, maximum.
2) Rated Operating Pressure: 60 PSI.
3) Rating Operating Temperature: 40 °F to 140 °F

c. Finish: Chrome-plated.
d. Construction:
1) 6” swivel gooseneck spout.
2) 8” O.C. water supply.
3) Quarter-turn wedge style handles.
4) Colored hot & cold indexes.
5) Wrist handles.

e. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.

3. Thermostatic Mixing Valve, Point of Use:
a. Basis of Design: Leonard, Model: 170A-LF.
b. Manufacturers:
1) Lawler Manufacturing Company, Inc.
2) Leonard Valve Company.
3) Zurn Industries, LLC.

c. Compliance:
1) ASSE 1070.
2) Low-lead compliant.

4. Accessories:
a. Wheel handle angle stops.
b. Rigid supplies.
c. Trap and waste insulated and offset to meet ADA compliance.
1) Manufacturers:
a) Truebro (IPS Corp.).

b) Plumberex Specialty Products Co.

B. (S-2) Sink, Two Compartment Sink w/ Left and Right Drainboards.
   1. Sink:
      a. Manufacturers:
         1) American Standard Brands.
         2) Elkay Manufacturing Co.
         3) Kohler Co.
         4) Mansfield Plumbing.
         5) PROFLO.
         6) Advance Tabco.
      b. Finish: #4 finish
      c. Construction:
         1) 16-gauge, 300 series stainless steel.
         2) 3-1/2-inch center drain opening.
         3) Left and Right drainboards and stainless steel legs.
      d. Dimensions:
         1) Faucet Holes: 2 holes, 8-inch center, 1-1/2-inch diameter, each faucet.
         2) Overall: 74-inch length, 29 13/16-inch width.
         3) Inside Bowl: 18-inch length, 24-inch width, 14-inches deep.
      e. Compliance:
         1) ASME A112.19.3.
   2. Trim:
      a. Manufacturers:
         1) Chicago Faucets.
         2) Delta Faucet Co.
         3) Elkay Manufacturing Co. (Dayton).
         4) Moen, Inc.
      b. Performance:
         1) Flow: 1.5 GPM, maximum.
         2) Faucet requires 2 faucet holes.
      c. Finish: Chrome-plated.
      d. Construction:
         1) Scrub/handwash 8” centerset wall mount faucet with 5” gooseneck spout 4” wristblade handles ½” offset inlet
         2) 4-Inch Vandal-Proof Wristblade Handle.
         3) Compression Operating Cartridge.
         4) Laminar Flow Control Insert In Spout Inlet.
         5) Volume Control and Hot Water Limit Stop Cartridge
         6) ½-Inch NPSM Supply Inlets and Coupling Nut For 3/8-Inch Or ½-Inch Flexible Riser
      e. Dimensions:
         1) Centers: (2) 4-inch fixed centers.
      f. Compliance:
         1) ASME A112.18.1.
         2) NSF 61
         3) NSF 372 – Low-lead compliant.
   3. Thermostatic Mixing Valve, Point of Use:

a. Basis of Design: Leonard, Model: 170A-LF.
b. Manufacturers:
1) Lawler Manufacturing Company, Inc.
2) Leonard Valve Company.
3) Zurn Industries, LLC.
c. Compliance:
1) ASSE 1070.
2) Low-lead compliant.
4. Accessories:
a. Wheel handle angle stops.
b. Rigid supplies.

C. (S-3) Sink, Double Bowl Drop-in, ADA compliant.
1. Sink:
a. Manufacturers:
1) American Standard Brands.
2) Elkay Manufacturing Co.
3) Kohler Co.
4) Mansfield Plumbing.
5) PROFLO.
b. Mount: Drop-in.
c. Finish: Lustrous Satin.
d. Construction:
1) 18-gauge, 304 stainless steel.
2) 3-1/2-inch rear center drain opening.
3) Sound deadening bottom only pads.
4) Includes mounting hardware, clips and screws.
5) Minimum cabinet size 36”.
e. Dimensions:
1) Bowl Depth: 5-1/2 inches.
2) Faucet Holes: Single hole, 1-1/2-inch diameter.
3) Overall: 33-inch length, 22-inch width.
4) Inside Bowl: 13-1/2-inch length, 16-inch width, 1-1/2-inch radius corners.
f. Compliance:
1) ASME A112.19.3.
2) ADA compliant.
2. Trim:
a. Manufacturers:
1) Chicago Faucets.
2) Delta Faucet Co.
3) Elkay Manufacturing Co. (Dayton).
4) Moen, Inc.
b. Performance:
1) Flow: 1.5 GPM, maximum.
2) Rated Operating Pressure: 20 PSI to 125 PSI.
3) Rating Operating Temperature: 40 °F to 140 °F
c. Construction:

1) Sink faucet for hot and cold water, single lever, single-hole deck mount, chrome plated.
2) Integral, tubular brass spout, 8-inch center-to-center.
3) 1.5 gpm pressure compensating, non-aerating, laminar outlet.
4) Ceramic quarter-turn cartridge, features square, tapered stem.
5) User-adjustable temperature control mixer. Includes temperature limiter.
6) ½-Inch NPSM Supply Inlets and Coupling Nut For 3/8-Inch Or ½-Inch Flexible Riser.

d. Dimensions:
1) Centers: Single-hole.

e. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.

3. Thermostatic Mixing Valve, Point of Use:
a. Basis of Design: Leonard, Model: 170A-LF.
b. Manufacturers:
1) Lawler Manufacturing Company, Inc.
2) Leonard Valve Company.
3) Zurn Industries, LLC.

c. Compliance:
1) ASSE 1070.
2) Low-lead compliant.

4. Accessories:
a. Wheel handle angle stops.
b. Rigid supplies.
c. Trap and waste insulated and offset to meet ADA compliance.
1) Manufacturers:
a) Truebro (IPS Corp.).
b) Plumberex Specialty Products Co.

D. (S-4) Sink, Single Bowl, Undermount, ADA compliant.
1. Sink:
a. Manufacturers:
1) American Standard Brands.
2) Elkay Manufacturing Co.
3) Kohler Co.
4) Mansfield Plumbing.
5) PROFLO.

b. Mount: Undermount.
c. Finish: Lustrous satin.
d. Construction:
1) 18-gauge, 304 stainless steel.
2) 3-1/2-inch rear center drain opening.
3) Sound deadening bottom only pads.
4) Minimum cabinet size 27”.

e. Dimensions:

1) Bowl Depth: 5-3/8 inches.
2) Overall: 21 1/2-inch length, 18 1/2-inch width.
3) Inside Bowl: 19-inch length, 16-inch width, 1-1/2-inch radius corners.

f. Compliance:
1) ASME A112.19.3.
2) ADA compliant.

2. Trim:
a. Manufacturers:
1) Chicago Faucets.
2) Delta Faucet Co.
3) Elkay Manufacturing Co. (Dayton).
4) Moen, Inc.

b. Performance:
1) Flow: 1.5 GPM, maximum.
2) Rated Operating Pressure: 20 PSI to 125 PSI.
3) Rating Operating Temperature: 40 °F to 140 °F

c. Construction:
1) Sink faucet for hot and cold water, concealed deck-mount with 8” fixed centers, chrome plated.
2) Rigid/swing gooseneck spout, 8” center-to-center.
3) 1.5 gpm pressure compensating vandal-proof Softflo aerator.
4) 4” metal, vandal-proof, wristblade handles with sixteen-point, tapered broach and secured blue and red index buttons.
5) Quaturn rebuildable compression cartridge, opens and closes 90°, closes the water pressure, features square, tapered stem.
6) ½-Inch NPSM Supply Inlets and Coupling Nut For 3/8-Inch Or ½-Inch Flexible Riser.
7) Mounting hardware included.

d. Dimensions:
1) Centers: 8” fixed centers.

e. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.

3. Thermostatic Mixing Valve, Point of Use:
a. Basis of Design: Leonard, Model: 170A-LF.
b. Manufacturers:
1) Lawler Manufacturing Company, Inc.
2) Leonard Valve Company.
3) Zurn Industries, LLC.

c. Compliance:
1) ASSE 1070.
2) Low-lead compliant.

4. Accessories:
a. Wheel handle angle stops.
b. Rigid supplies.
c. Trap and waste insulated and offset to meet ADA compliance.

1) Manufacturers:
    a) Truebro (IPS Corp.).
    b) Plumberex Specialty Products Co.

E. (S-5) Sink, Single Bowl Drop-in, ADA compliant.
1. Sink:
    a. Manufacturers:
        1) American Standard Brands.
        2) Elkay Manufacturing Co.
        3) Kohler Co.
        4) Mansfield Plumbing.
        5) PROFLO.
    b. Mount: Drop-in.
    c. Finish: Lustrous Satin.
    d. Construction:
        1) 18-gauge, 304 stainless steel.
        2) 3-1/2-inch rear center drain opening.
        3) Sound deadening bottom only pads.
        4) Includes mounting hardware, clips and screws.
        5) Minimum cabinet size 24”.
    e. Dimensions:
        1) Bowl Depth: 5-1/2 inches.
        2) Faucet Holes: Single hole, 1-1/2-inch diameter.
        3) Overall: 19 1/2-inch length, 19-inch width.
        4) Inside Bowl: 16-inch length, 13 1/2-inch width, 1-1/2-inch radius corners.
    f. Compliance:
        1) ASME A112.19.3.
        2) ADA compliant.
2. Trim:
    a. Manufacturers:
        1) Chicago Faucets.
        2) Delta Faucet Co.
        3) Elkay Manufacturing Co. (Dayton).
        4) Moen, Inc.
    b. Performance:
        1) Flow: 1.5 GPM, maximum.
        2) Rated Operating Pressure: 20 PSI to 125 PSI.
        3) Rating Operating Temperature: 40 ˚F to 140 ˚F
    c. Construction:
        1) Sink faucet for hot and cold water, single lever, deck-mounted with single hole mounting, chrome plated.
        2) Integral, tubular SUS 304 stainless steel spout.
        3) 1.5 gpm laminar flow outlet.
        4) Flexible supply hoses included.
    d. Dimensions:
        1) Centers: Single-hole.
    e. Compliance:
        1) ASME A112.18.1.

2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.

3. Thermostatic Mixing Valve, Point of Use:
   a. Basis of Design: Leonard, Model: 170A-LF.
   b. Manufacturers:
      1) Lawler Manufacturing Company, Inc.
      2) Leonard Valve Company.
      3) Zurn Industries, LLC.
   c. Compliance:
      1) ASSE 1070.
      2) Low-lead compliant.
4. Accessories:
   a. Wheel handle angle stops.
   b. Rigid supplies.
   c. Trap and waste insulated and offset to meet ADA compliance.
      1) Manufacturers:
         a) Truebro (IPS Corp.).
         b) Plumberex Specialty Products Co.

F. (S-6) Sink, Single Bowl, Chemical Resistant.
1. Sink:
   1) By Others.
2. Trim:
   a. Manufacturers:
      1) Chicago Faucets.
      2) Delta Faucet Co.
      3) Elkay Manufacturing Co. (Dayton).
      4) Moen, Inc.
   b. Performance:
      1) Flow: 2.2 GPM, maximum.
      2) Rated Operating Pressure: 20 PSI to 125 PSI.
      3) Rating Operating Temperature: 40 °F to 140 °F
   c. Construction:
      1) Sink faucet for hot and cold water, with vacuum breaker, single-hole deck mount, chrome plated.
      2) Rigid/swing gooseneck spout with atmospheric vacuum breaker, 8” center-to-center.
      3) 2.2 gpm pressure compensating, non-aerating, laminar flow outlet.
      4) 4” metal, vandal-proof, wristblade handles with sixteen-point, tapered broach and secured blue and red index buttons.
      5) Ceramic quarter-turn cartridge, features square, tapered stem.
      6) Flexible supply hoses with 3/8” compression fitting.
   d. Dimensions:
      1) Centers: Single-hole.
   e. Compliance:
      1) ASME A112.18.1.
      2) NSF 61

3) NSF 372 – Low-lead compliant.

3. Thermostatic Mixing Valve, Point of Use:
   a. Basis of Design: Leonard, Model: 170A-LF.
   b. Manufacturers:
      1) Lawler Manufacturing Company, Inc.
      2) Leonard Valve Company.
      3) Zurn Industries, LLC.
   c. Compliance:
      1) ASSE 1070.
      2) Low-lead compliant.
4. Accessories:
   a. Wheel handle angle stops.
   b. Rigid supplies.

G. (S-7) Sink, Single Bowl, Chemical Resistant, ADA compliant.
1. Sink:
   1) By Others.
2. Trim:
   a. Manufacturers:
      1) Chicago Faucets.
      2) Delta Faucet Co.
      3) Elkay Manufacturing Co. (Dayton).
      4) Moen, Inc.
   b. Performance:
      1) Flow: 2.2 GPM, maximum.
      2) Rated Operating Pressure: 20 PSI to 125 PSI.
      3) Rating Operating Temperature: 40 °F to 140 °F
   c. Construction:
      1) Sink faucet for hot and cold water, with vacuum breaker, single-hole deck mount, chrome plated.
      2) Rigid/swing gooseneck spout with atmospheric vacuum breaker, 8” center-to-center.
      3) 2.2 gpm pressure compensating, non-aerating, laminar flow outlet.
      4) 4” metal, vandal-proof, wristblade handles with sixteen-point, tapered broach and secured blue and red index buttons.
      5) Ceramic quarter-turn cartridge, features square, tapered stem.
      6) Flexible supply hoses with 3/8” compression fitting.
   d. Dimensions:
      1) Centers: Single-hole.
   e. Compliance:
      1) ASME A112.18.1.
      2) NSF 61
      3) NSF 372 – Low-lead compliant.
      4) ICC A117.1 - ADA compliant.
3. Thermostatic Mixing Valve, Point of Use:
   a. Basis of Design: Leonard, Model: 170A-LF.
   b. Manufacturers:
      1) Lawler Manufacturing Company, Inc.

2) Leonard Valve Company.
3) Zurn Industries, LLC.

c. Compliance:
1) ASSE 1070.
2) Low-lead compliant.

4. Accessories:
a. Wheel handle angle stops.
b. Rigid supplies.
c. Trap and waste insulated and offset to meet ADA compliance.
1) Manufacturers:
a) Truebro (IPS Corp.).
b) Plumberex Specialty Products Co.

H. (S-8) Hand Sink, Wall Hung, ADA Compliant.
1. Sink:
a. Manufacturers:
1) American Standard Brands.
2) Kohler Co.
3) Mansfield Plumbing.
4) PROFLO.
b. Mounting: Wall-mounted with hangers.
c. Color: White.
d. Compliance:
1) ASME A112.19.2.
2) ADA compliant.
2. Faucet:
a. Manufacturers:
1) Bradley Corp.
2) Chicago Faucets.
3) Delta Faucet Co.
4) Elkay Manufacturing Co. (Dayton).
5) Moen, Inc.
6) Sloan Valve Company.
b. Performance:
1) Flow: 0.5 GPM.
2) Power: Hardwired.
c. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.
3. Thermostatic Mixing Valve, Point of Use:
a. Basis of Design: Leonard, Model: 170A-LF.
b. Manufacturers:
1) Lawler Manufacturing Company, Inc.
2) Leonard Valve Company.
3) Zurn Industries, LLC.
c. Compliance:

1) ASSE 1070.
2) Low-lead compliant.

4. Accessories:
   a. Wheel handle angle stops.
   b. Rigid supplies.
   c. Trap and waste insulated and offset to meet ADA compliance.
      1) Manufacturers:
         a) Truebro (IPS Corp.).
         b) Plumberex Specialty Products Co.
5. Wall Mounted Carrier:
   a. Hanger to be included with sink.

I. (S-9) Sink, Single Bowl, Undermount, ADA compliant.
   1. Sink:
      a. Manufacturers:
         1) American Standard Brands.
         2) Elkay Manufacturing Co.
         3) Kohler Co.
         4) Mansfield Plumbing.
         5) PROFLO.
      b. Mount: Undermount.
      c. Finish: Lustrous satin.
      d. Construction:
         1) 18-gauge, 304 stainless steel.
         2) 3-1/2-inch rear center drain opening.
         3) Sound deadening bottom only pads.
         4) Minimum cabinet size 27”.
      e. Dimensions:
         1) Bowl Depth: 5-3/8 inches.
         2) Overall: 21 1/2-inch length, 18 1/2-inch width.
         3) Inside Bowl: 19-inch length, 16-inch width, 1-1/2-inch radius corners.
      f. Compliance:
         1) ASME A112.19.3.
         2) ADA compliant.
   2. Trim:
      a. Manufacturers:
         1) Chicago Faucets.
         2) Delta Faucet Co.
         3) Elkay Manufacturing Co. (Dayton).
         4) Moen, Inc.
      b. Performance:
         1) Flow: 1.5 GPM, maximum.
         2) Rated Operating Pressure: 20 PSI to 125 PSI.
         3) Rating Operating Temperature: 40 °F to 140 °F
      c. Construction:
         1) Sink faucet for hot and cold water, concealed deck-mount with 8” fixed centers, chrome plated.
         2) Rigid/swing gooseneck spout, 8” center-to-center.

3) 1.5 gpm pressure compensating vandal-proof Softflo aerator.
4) 4" metal, vandal-proof, wristblade handles with sixteen-point, tapered broach and secured blue and red index buttons.
5) Quaturn rebuildable compression cartridge, opens and closes 90°, closes the water pressure, features square, tapered stem.
6) ½-Inch NPSM Supply Inlets and Coupling Nut For 3/8-Inch Or ½-Inch Flexible Riser.
7) Mounting hardware included.

d. Dimensions:
1) Centers: 8" fixed centers.

e. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 - ADA compliant.

3. Thermostatic Mixing Valve, Point of Use:
a. Basis of Design: Leonard, Model: 170A-LF.
b. Manufacturers:
1) Lawler Manufacturing Company, Inc.
2) Leonard Valve Company.
3) Zurn Industries, LLC.

c. Compliance:
1) ASSE 1070.
2) Low-lead compliant.

4. Accessories:
a. Wheel handle angle stops.
b. Rigid supplies.
c. Trap and waste insulated and offset to meet ADA compliance.
1) Manufacturers:
a) Truebro (IPS Corp.).
b) Plumberex Specialty Products Co.

J. (S-10) Deck-mounted laboratory turret with needle valve, ADA compliant.
1. Trim:
a. Manufacturers:
1) Chicago Faucets.
2) Delta Faucet Co.
3) Elkay Manufacturing Co. (Dayton).
4) Moen, Inc.

b. Performance:
1) Rated Operating Pressure: 125 PSI max.

c. Construction:
1) Deck-mounted laboratory turret with needle valve, polished chrome finish.
2) Laboratory nozzle with 10 serrations for laboratory hose.
3) 2-1/2" cross handle.
4) Includes index buttons for AIR, GAS, VAC.

d. Dimensions:
1) Centers: Single-hole.

e. Compliance:
    1) ICC A117.1 - ADA compliant.
    2) ANSI Z21.15b/CSA 9.1b

K. (S-11) Sink, Single Bowl, Undermount, ADA compliant.
1. Sink:
    a. Manufacturers:
        1) American Standard Brands.
        2) Elkay Manufacturing Co.
        3) Kohler Co.
        4) Mansfield Plumbing.
        5) PROFLO.
    b. Mount: Undermount.
    c. Finish: Lustrous satin.
    d. Construction:
        1) 18-gauge, 304 stainless steel.
        2) 3-1/2-inch rear center drain opening.
        3) Sound deadening bottom only pads.
        4) Minimum cabinet size 27”.
    e. Dimensions:
        1) Bowl Depth: 5-3/8 inches.
        2) Overall: 21 1/2-inch length, 18 1/2-inch width.
        3) Inside Bowl: 19-inch length, 16-inch width, 1-1/2-inch radius corners.
    f. Compliance:
        1) ASME A112.19.3.
        2) ADA compliant.
2. Trim:
    a. Manufacturers:
        1) Chicago Faucets.
        2) Delta Faucet Co.
        3) Elkay Manufacturing Co. (Dayton).
        4) Moen, Inc.
    b. Performance:
        1) Flow: 1.5 GPM, maximum.
        2) Rated Operating Pressure: 20 PSI to 125 PSI.
        3) Rating Operating Temperature: 40 ˚F to 140 ˚F
    c. Construction:
        1) Sink faucet for hot and cold water, concealed deck-mount with 8” fixed centers, chrome plated.
        2) Rigid/swing gooseneck spout, 8” center-to-center.
        3) 1.5 gpm pressure compensating vandal-proof Softflo aerator.
        4) 4” metal, vandal-proof, wristblade handles with sixteen-point, tapered broach and secured blue and red index buttons.
        5) Quaturn rebuildable compression cartridge, opens and closes 90°, closes the water pressure, features square, tapered stem.
        6) ½-Inch NPSM Supply Inlets and Coupling Nut For 3/8-Inch Or ½-Inch Flexible Riser.
        7) Mounting hardware included.

d. Dimensions:
    1) Centers: 8” fixed centers.
e. Compliance:
    1) ASME A112.18.1.
    2) NSF 61
    3) NSF 372 – Low-lead compliant.
    4) ICC A117.1 - ADA compliant.

3. Thermostatic Mixing Valve, Point of Use:
    a. Basis of Design: Leonard, Model: 170A-LF.
    b. Manufacturers:
        1) Lawler Manufacturing Company, Inc.
        2) Leonard Valve Company.
        3) Zurn Industries, LLC.
    c. Compliance:
        1) ASSE 1070.
        2) Low-lead compliant.
4. Accessories:
    a. Wheel handle angle stops.
    b. Rigid supplies.
    c. Trap and waste insulated and offset to meet ADA compliance.
        1) Manufacturers:
            a) Truebro (IPS Corp.).
            b) Plumberex Specialty Products Co.

L. (S-12) Sink, Single Bowl Drop-in, ADA compliant.
1. Sink:
    a. Manufacturers:
        1) American Standard Brands.
        2) Elkay Manufacturing Co.
        3) Kohler Co.
        4) Mansfield Plumbing.
        5) PROFLO.
    b. Mount: Drop-in.
    c. Finish: Lustrous Satin.
    d. Construction:
        1) 18-gauge, 304 stainless steel.
        2) 3-1/2-inch rear center drain opening.
        3) Sound deadening bottom only pads.
        4) Includes mounting hardware, clips and screws.
        5) Minimum cabinet size 24”.
    e. Dimensions:
        1) Bowl Depth: 5-1/2 inches.
        2) Faucet Holes: Single hole, 1-1/2-inch diameter.
        3) Overall: 19 1/2-inch length, 19-inch width.
        4) Inside Bowl: 16-inch length, 13 1/2-inch width, 1-1/2-inch radius corners.
    f. Compliance:
        1) ASME A112.19.3.
        2) ADA compliant.

2. Trim:
    a. Manufacturers:
        1) Chicago Faucets.
        2) Delta Faucet Co.
        3) Elkay Manufacturing Co. (Dayton).
        4) Moen, Inc.
    b. Performance:
        1) Flow: 1.5 GPM, maximum.
        2) Rated Operating Pressure: 20 PSI to 125 PSI.
        3) Rating Operating Temperature: 40 °F to 140 °F
    c. Construction:
        1) Sink faucet for hot and cold water, single lever, deck-mounted with single hole mounting, chrome plated.
        2) Integral, tubular SUS 304 stainless steel spout.
        3) 1.5 gpm laminar flow outlet.
        4) Flexible supply hoses included.
    d. Dimensions:
        1) Centers: Single-hole.
    e. Compliance:
        1) ASME A112.18.1.
        2) NSF 61
        3) NSF 372 – Low-lead compliant.
        4) ICC A117.1 - ADA compliant.
3. Thermostatic Mixing Valve, Point of Use:
    a. Basis of Design: Leonard, Model: 170A-LF.
    b. Manufacturers:
        1) Lawler Manufacturing Company, Inc.
        2) Leonard Valve Company.
        3) Zurn Industries, LLC.
    c. Compliance:
        1) ASSE 1070.
        2) Low-lead compliant.
4. Accessories:
    a. Wheel handle angle stops.
    b. Rigid supplies.
    c. Trap and waste insulated and offset to meet ADA compliance.
        1) Manufacturers:
            a) Truebro (IPS Corp.).
            b) Plumberex Specialty Products Co.

M. (WF-1) Wall mounted manual faucet with 8” centers:
1. Trim:
    a. Manufacturers:
        1) Chicago Faucets.
        2) Delta Faucet Co.
        3) Elkay Manufacturing Co. (Dayton).
        4) Moen, Inc.
        5) Speakman Company.

b. Finish: Rough chrome-plated.
c. Mounted: Wall-mounted
d. Construction:
1) Vacuum breaker spout, with pail hook and wall brace.
2) 2-3/8-inch metal, vandal-proof, lever handles with sixteen-point, tapered broach and secured blue and red index buttons.
3) Rebuildable compression cartridge, opens and close 90 degrees, closes with water pressure.
4) Adjustable supply arm includes ½-inch NPT female union nut.
5) ¾-inch male hose thread outlet.
6) Round wall escutcheons.
7) Integral stop valves.
e. Dimensions:
1) Centers: 7-5/8-inch to 8-3/8-inch adjustable centers.
f. Compliance:
1) ASME A112.18.1
2) ICC A117.1 – ADA Compliance.

N. (WF-2) Wall mounted manual faucet with adjustable centers:
1. Trim:
a. Manufacturers:
1) Chicago Faucets.
2) Delta Faucet Co.
3) Elkay Manufacturing Co. (Dayton).
4) Moen, Inc.
5) Speakman Company.
b. Finish: Rough chrome-plated.
c. Mounted: Wall-mounted
d. Construction:
1) Sink faucet for hot and cold water, wall-mounted 3-3/8” body with adjustable arms for 3” – 8-3/8” centers.
2) Double jointed swing spout, 18” center-to-center.
3) 2.2 gpm pressure compensating Softflo aerator.
4) 2-3/8” metal, vandal-proof, lever handles with sixteen-point, tapered broach and secured blue and red index buttons.
5) Quaturn rebuildable compression cartridge, opens and closes 90°, closes with water pressure, features square, tapered stem.
e. Compliance:
1) ASME A112.18.1
2) ICC A117.1 – ADA Compliance.

2.5 SHOWERS

A. (SH-1) Surface-Mounted ADA Compliant Wall Shower.
1. Manufacturers:
a. Bradley Corp, or approved equal.
b. Acorn.
2. Construction:

a. Coordinate with drawings for right or left-handed configuration depending on location of valve.
b. Shower Panel - Constructed of 16-gauge stainless steel.
c. Equa-Flo HD Pressure-Balancing Valve.
d. Showerhead - Standard fixed direction adjustable sprayhead.
e. Diverter Valve - Lever handle operation for easy transfer of water flow between fixed and hand-held shower spray.
f. Hand Shower – Consisting of hand shower with on-off control, a 60" stainless steel flexible hose and post style mounting bracket to hold to shower panel. Elevated in-line backflow preventer with quick-disconnect for flexible hose.
g. Supply Inlets – 24" flexible, stainless steel hoses with ½-inch NPT connections.
h. Flow Control – 1.5 gpm flow control.

3. Compliance:
   a. Compliance:
      1) ANSI A117.1.
      2) ADA compliant.
4. Accessories:
   a. Grab bars
   b. Fold-up seat.
   c. Curtain rod and/or shower curtain.
   d. PVC shower floor drain with stainless steel safety grate.

B. (SH-2) Individual Coverall Wall Shower:
1. Manufacturers:
   a. Bradley Corp, or approved equal.
   b. Acorn.
2. Construction:
   a. Shower Panel – Constructed of 18-gauge stainless steel with stainless steel soap dish mounted to panel. Shower panel top and bottom covers are sloped, and constructed of 16-gauge stainless steel.
   b. Equa-Flo HD Pressure-Balancing Valve.
   c. Showerhead - standard fixed direction adjustable sprayhead.
   d. Supply Inlets – Flexible, stainless steel hoses with ½-inch NPT connections. Inlets are accessible through the back of the shower or through knockouts in the top and bottom covers.
   e. Flow Control – 1.5 gpm flow control.
3. Accessories:
   a. Soap Dish.
   b. Curtain rod and/or shower curtain.
   c. PVC shower floor drain with stainless steel safety grate.

C. (SH-3) Shower, ADA compliant.
1. Shower:
   a. Tiled by others.
2. Shower Faucet Trim Only:
   a. Manufacturers:
      1) Chicago Faucets.
      2) Delta Faucet Co.
      3) Elkay Manufacturing Co. (Dayton).

4) Moen, Inc.
5) Speakman Company.
6) American Standard.

b. Shower Faucet Trim:
1) Maintains a balanced pressure of hot and cold water even when a valve is turned on or off elsewhere in the system.
2) 2.0 gpm @ 80 psi.
3) For use with MultiChoice®Universal rough valve body (R10000 Series).
4) Solid brass forged body.
5) Red/Blue indicators on handle.
6) Lever volume control handle; temperature adjustment dial.
7) Field adjustable to limit handle rotation into hot water zone.
8) Maximum dial rotation adjustable between 90° and 180°.

c. MultiChoice® Universal Rough Valve Body:
1) Forged brass body.
2) Can be tested with air (200 psi) or water (300 psi) without valve using supplied test cap.
3) Square plasterguard allows for right angle cuts.
4) Thin wall mounting.
5) For use with MultiChoice® Universal single or dual function trim.
6) ½" outlets and connections.

d. Personal Hand-Held Shower:
1) 2.5 gpm @ 80 psi.
2) Certified dual check valves for backflow protection.
3) Hand held shower with three spray settings.
4) 60" – 82" stretchable metal hose.
5) Wall bar for hands-free showering.
6) Wall bar w/adjustable slide (allows for adjustable shower height). Not to be used as a grab bar.

e. Diverter, ADA compliant:
1) All brass construction.
2) Diverts water.

3. Accessories:
a. PVC shower floor drain with stainless steel safety grate.
b. Grab Bars.
c. ADA Compliant Seat.
d. Slide Bar.
e. Curtain rod and/or shower curtain.

4. Compliance:
a. ASME A112.18.1.
b. ASSE 1016.
c. NSF 61.
d. NSF 372 – Low-lead compliant.
e. ADA Compliant.

D. (SH-4) Shower.
1. Shower:
a. Tiled by others.

2. Shower Faucet Trim Only:
    a. Manufacturers:
        1) Chicago Faucets.
        2) Delta Faucet Co.
        3) Elkay Manufacturing Co. (Dayton).
        4) Moen, Inc.
        5) Speakman Company.
        6) American Standard.
    b. Shower Faucet Trim:
        1) Maintains a balanced pressure of hot and cold water even when a valve is turned on or off elsewhere in the system.
        2) 2.0 gpm @ 80 psi.
        3) For use with MultiChoice®Universal rough valve body (R10000 Series).
        4) Solid brass forged body.
        5) Red/Blue indicators on handle.
        6) Lever volume control handle; temperature adjustment dial.
        7) Field adjustable to limit handle rotation into hot water zone.
        8) Maximum dial rotation adjustable between 90° and 180°.
    c. MultiChoice® Universal Rough Valve Body:
        1) Forged brass body.
        2) Can be tested with air (200 psi) or water (300 psi) without valve using supplied test cap.
        3) Square plasterguard allows for right angle cuts.
        4) Thin wall mounting.
        5) For use with MultiChoice® Universal single or dual function trim.
        6) ½" outlets and connections.
3. Accessories:
    a. PVC shower floor drain with stainless steel safety grate.
    b. Curtain rod and/or shower curtain.
4. Compliance:
    a. ASME A112.18.1.
    b. ASSE 1016.
    c. NSF 61.
    d. NSF 372 – Low-lead compliant.

2.6 DRINKING FOUNTAINS

A. (DF-1) Drinking Fountains, Bi-Level Filtered Cooler with Bottle Filling Station.
1. Manufacturers:
    a. Acorn Engineering Co. (Morris Group International).
    b. Halsey Taylor.
    c. Haws Corp.
    d. Elkay Manufacturing Co.
2. Compliance:
    a. ADA & ICC A117.1
    b. ASME A112.19.3/CSA B45.4
    c. CAN/CSA C22.2 NO. 120
    d. GreenSpec.
    e. NSF/ANSI 42, 53, 61, 372 (lead free), & 401.

f. UL 399.
g. Bottle filling unit shall meet ADA guidelines for parallel approach. Cooler shall meet ADA guidelines for frontal or parallel approach.

B. (DF-2) Bottle Filling Station, Surface Mount, ADA compliant.
1. Manufacturers:
a. Acorn Engineering Co. (Morris Group International).
b. Halsey Taylor.
c. Haws Corp.
d. Elkay Manufacturing Co.
2. Basis of design: Oasis P8FPM, Fully-Recessed.
3. Construction:
a. Unit shall deliver 8.0 gph of 50°F water at 90°F ambient and 80°F inlet water. Shall have a push button on the front of the cabinet. Cabinet finish shall be sandstone powder coated paint on galvanized steel or brushed stainless steel. Shall use R-134a refrigerant. Dial-A-Drink bubbler, waterways are Lead-Free in materials and construction, stainless steel top, welded heavy-gauge steel frame, high efficiency cooling system.
4. Finishes: Standard cabinet finish – sandstone powder coated paint on galvanized steel. Optional finishes (at additional cost) – stainless steel and optional Greystone powder coated finishes. Verify with owner/architect.
5. Compliance:
a. ADA & ICC A117.1
b. ASME A112.19.3/CSA B45.4
c. CAN/CSA C22.2 NO. 120
d. GreenSpec.
e. NSF/ANSI 42, 53, 61, 372 (lead free), & 401.
f. UL 399.
g. Bottle filling unit shall meet ADA guidelines for parallel approach.

C. (BF-1) Bottle Filling Station, Surface Mount, ADA compliant.
1. Manufacturers:
a. Acorn Engineering Co. (Morris Group International).
b. Halsey Taylor.
c. Haws Corp.
d. Elkay Manufacturing Co.
2. Basis of design: Oasis MW8EBF.
3. Construction:
a. Unit shall deliver 8.0 gph of 50°F water at 90°F ambient and 80°F inlet water per ASHRAE 18 testing. Shall be recessed in design. Water flow to the bottler filler is by means of an electronically activated solenoid. Shall include the Aqua Pointe™ Bottle Filler with contactless activation and laminar flow. Bottle filler alcove and cabinet finish shall be stainless steel. Key Aqua Pointe™ bottle filler components contain Freshield®, which utilizes a silver-based antimicrobial compound to protect the surfaces from discoloration, odors and degradation caused by the growth of micro-organisms and mildew. Shall use R-134a refrigerant.
4. Finishes: Standard cabinet finish is stainless steel.
5. Compliance:
a. ADA & ICC A117.1

b. ASME A112.19.3/CSA B45.4
c. CAN/CSA C22.2 NO. 120
d. GreenSpec.
e. NSF/ANSI 42, 53, 61, 372 (lead free), & 401.
f. UL 399.
g. Bottle filling unit shall meet ADA guidelines for parallel approach.

2.7 SERVICE SINKS

A. (MS-1) Mop Sink:
1. Basin:
a. Manufacturers:
1) Acorn Engineering Co. (Morris Group International).
2) American Standard Brands.
3) E.L. Mustee & Sons, Inc.
4) Kohler Co.
5) Stern-Williams Company, Inc.
b. Color: Colorfast marbleized white finish.
c. Construction:
1) Basin constructed from one-piece molded, high-impact resistant, structural fiberglass.
2) Integral, mold-in drain for connection to 3-inch ABS, PVC (Sch. 80) or Cast Iron.
3) Removable stainless steel strainer.
4) Drain seals for connection to 3-inch soil pipe.
d. Dimensions: 10 inches high, 24 inches wide, 24 inches deep.
e. Compliance:
1) ANSI Z124
2) ASTM D635, ASTM E84, ASTM E162.
2. Trim:
a. Manufacturers:
1) Chicago Faucets.
2) Delta Faucet Co.
3) Elkay Manufacturing Co. (Dayton).
4) Moen, Inc.
5) Speakman Company.
b. Finish: Rough chrome-plated.
c. Mounted: Wall-mounted
d. Construction:
1) Vacuum breaker spout, with pail hook and wall brace.
2) 2-3/8-inch metal, vandal-proof, lever handles with sixteen-point, tapered broach and secured blue and red index buttons.
3) Rebuildable compression cartridge, opens and close 90 degrees, closes with water pressure.
4) Adjustable supply arm includes ½-inch NPT female union nut.
5) ¾-inch male hose thread outlet.
6) Round wall escutcheons.
7) Integral stop valves.
e. Dimensions:

1) Centers: 7-5/8-inch to 8-3/8-inch adjustable centers.

f. Compliance:

1) ASME A112.18.1

2) ICC A117.1 – ADA Compliance.

3. Accessories:

a. 5 feet of 1/2 inch diameter plain end reinforced rubber hose.

b. Hose clamp hanger.

c. Mop Hanger.

B. (LT-1) Laundry Utility Sink:

1. Basin:

a. Manufacturers:

1) Acorn Engineering Co. (Morris Group International).

2) American Standard Brands.

3) E.L. Mustee & Sons, Inc.

4) Kohler Co.

5) Stern-Williams Company, Inc.

b. Construction: Tub shall be one-piece molded construction using DURASTONE®, a blend of natural crushed stone and polyester resins molded with matched metal molds under extreme heat and pressure. Tub to include integrally molded drain assembly for connection to standard 1-1/2"P-trap, stopper and wall mounting hardware or heavy gauge steel legs with built-in levelers. 18 gallon capacity tub, 13" deep. Shall meet ANZI 124-2011.

c. Color: White.

d. Compliance: Shall meet ANSI Z 124-2011.

2. Trim:

a. Manufacturers:

1) Speakman Company.

2) Chicago Faucets.

3) Kohler.

4) Moen.

5) American Standard.

b. Construction: Deck mounted 4" fixed centers hot and cold-water sink faucet, chrome plated. 2-3/8" metal, vandal-proof, lever handles with sixteen-point, tapered broach and secured blue and red index buttons. Quaturn® rebuildable compression cartridge, opens and closes 90°, closes with water pressure, features square, tapered stem. ½" NPSM supply inlets and coupling nut for 3/8" or 12" flexible riser.

c. Compliance:

1) ASME A112.18.1

2) ICC A117.1 – ADA Compliance.

3) NSF 61.

4) NSF 372 – Low lead compliant.

C. (LT-2) Stainless Steel Utility Sink.

1. Basin:

a. Manufacturers:

1) Acorn Engineering Co. (Morris Group International).

2) American Standard Brands.

3) E.L. Mustee & Sons, Inc.
4) Kohler Co.
5) Stern-Williams Company, Inc.
6) Elkay.

b. Construction:
1) Dependabilt™ stainless steel 21" x 21-1/2" x 42" 18 gauge one compartment budget sink with stainless steel legs. Sink is manufactured from 18 gauge 300 series stainless steel with a #4 finish, center drain placement.

c. Compliance:
1) ASME A112.19.3.

2. Faucet:
a. Manufacturers:
1) Speakman Company.
2) Acorn Engineering Co. (Morris Group International).
3) American Standard Brands.
4) E.L. Mustee & Sons, Inc.
5) Kohler Co.
6) Stern-Williams Company, Inc.

b. Constuction:
1) Scrub/Handwash 8" centerset wall mount faucet with 5" gooseneck spout 4" wristblade handles ½" offset inlet. Faucet has a flow rate of 1.5 GPM, and is made of chrome-plated brass material, with quarter turn ceramic disc valve. Faucet requires 2 faucet holes.

c. Compliance:
1) ASME A112.18.1.
2) NSF 61
3) NSF 372 – Low-lead compliant.
4) ICC A117.1 – ADA Compliance.

D. (LT-3) Utility Tub Combo:
1. Basin:
a. Manufacturers:
1) Acorn Engineering Co. (Morris Group International).
2) American Standard Brands.
3) E.L. Mustee & Sons, Inc.
4) Kohler Co.
5) Stern-Williams Company, Inc.

b. Construction: BIGTUB™ UTILATUB™ Utility Tub shall be one-piece molded polypropylene with matched metal molds. Kit includes: Swivel faucet with 24" long pull-out spout with lever handles; 1-1/2" p-trap with 12" tailpiece; two flexible, 20" long braided supply lines; steel legs with adjustable levelers; and 1-1/2" molded-in drain and drain stopper. 36-gallon capacity.

c. Color: White.

d. Compliance:
1) Shall meet ANSI Z 124-2011.
2) ASME A112.18.1.
3) NSF 61
4) NSF 372 – Low-lead compliant.
5) ICC A117.1 – ADA Compliance.

2.8 SAFETY FIXTURES

A. (EEW-1) Emergency Eye Wash:
   1. Manufacturers:
      a. Acorn Safety (Morris Group International).
      b. Bradley Corp.
      c. Encon Safety Products.
      d. Haws.
      e. Speakman.
   2. Basis of Design: Stingray Systems T2235 Wall Mounted Barrier-Free Eyewash.
      a. Construction:
         1) Wall mounted unit that includes an integrated mixing valve so that the plumbing can be run directly to the eyewash.
         2) The eyewash shall be manufactured of corrosion resistant materials.
         3) The manifold assembly shall be nickel-plated brass unit with machined ½" connections with check valves for hot and cold-water inlet connections and 1" NPT female connection for drain piping.
         4) It shall include a centrally located activator with universal ANSI compliant sign.
         5) The manifold shall include an integral emergency eye/face wash mixing valve that shall control outlet temperature over a wide range of flow and shall be suitable for single eyewash or face/face wash applications in order to comply with the latest ANSI/ISEA Z358.1 requirements.
         6) Temperature adjustment shall be vandal resistant.
         7) As an eyewash, this unit will have a regulated flow rate of less than 3 gpm measured at 30 psi.
         8) The bowl assembly shall include a First Aid Red ABS bowl (or stainless steel bowl). The spray heads shall be PVC with dust caps and designed to flow at the specified flow rate.
   3. Finish: Verify with owner/architect.

B. (EEW-2) Deck Mounted Swing Out Eye & Eye/Face Wash:
   1. Manufacturers:
      a. Acorn Safety (Morris Group International).
      b. Bradley Corp.
      c. Encon Safety Products.
      d. Haws.
      e. Speakman.
   2. Basis of Design: Stingray Systems S2561 Deck Mounted Eye/Face Wash.
      a. Construction:
         1) Emergency eyewash or eye/face wash that is swing-out operated.
         2) The eyewash shall be manufactured of corrosion resistant materials.
         3) A ceramic stay open valve, that is housed in a lead-free brass body, accomplishes the activation of the unit.
         4) The water will start to flow once the arm is pulled out over the sink. Turning the water off is accomplished by simply pushing the arm back towards the edge of the sink.
         5) It shall include a universal ANSI compliant sign.

6) The spray heads shall be ABS with dust caps and incorporated into a Quick Switch Eyewash Block that can be easily removed and serviced, allowing the supply piping to be flushed.
7) As an eyewash, this unit will have a regulated flow rate of less than 3 gpm measured at 30 psi. As an eye/face wash, it shall deliver a regulated flow of more than 3 gpm, measured at 30 psi.
8) Provide Stingray thermostatic mixing valve model SV107. ASSE Lead Free Certified. ASSE 1071 Approved. Inlets and outlets are ½" NPT.

3. Finish: Verify with owner/architect.

C. (EEW/SH-1) Combination Shower and Eye and Face Wash:
1. Manufacturers:
a. Acorn Safety (Morris Group International).
b. Bradley Corp.
c. Encon Safety Products.
d. Haws.
e. Speakman.
2. Basis of Design: Stingray Systems T5515 Floor Mounted Barrier-Free Eye/Face
a. Construction:
1) Unit includes an integrated mixing valve so that the plumbing can be run directly to the unit.
2) The combination shower shall be manufactured of corrosion resistant materials.
3) The integral valve assembly shall be nickel-plated brass unit with machined 1-1/4" connections with check valves for hot and cold water inlet connections.
4) It shall include a centrally located activator with universal ANSI compliant sign.
5) The bowl assembly shall include First Aid Red ABS or Stainless Steel bowl. The spray heads shall be PVC with dust caps and designed to flow at the specified flow rate.
6) The unit shall include a First Aid Red ABS or Stainless Steel showerhead designed to give the user uniform and non-forceful flow over the entire coverage area at 20 gpm at 30 psi. A stainless steel pull handle connected to the nickel-plated ball valve accomplishes activation of the shower.
3. Finish: Verify with owner/architect.
4. Compliance:
a. ADA Compliant.
b. ANSI Z358.1.
c. ASSE 1071 Approved.

2.9 VALVE BOX

A. (WB-1) Laundry Valve and Drain Box – Washer:
1. Manufacturers:
a. Guy Gray; IPS Corporation.
b. Water Tite.
c. Oatey.

B. (IM-1) Ice Maker Outlet Box:

1. Manufacturers:
    a. Guy Gray; IPS Corporation.
    b. Water Tite.
    c. Oatey.

C. (CM-1) Coffee Maker Outlet Box:
1. Manufacturers:
    a. Guy Gray; IPS Corporation.
    b. Water Tite.
    c. Oatey.

2.10 LAVATORY INSULATION KIT

A. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify electric power is available and of correct characteristics.

C. Confirm millwork is constructed with adequate provision for installation of counter-top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install Work in accordance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall supports or wall carriers and bolts.

F. Seal fixtures to wall and floor surfaces with sealant as specified in , color to match fixture.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF FINISHED WORK

A. Do not permit use of fixtures before final acceptance.

3.8 SCHEDULES

A. Fixture Mounting Heights: Refer to Architectural Drawings and Specifications.

B. Fixture Rough-In: Refer to Drawings.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes single- and three-phase motors for application on equipment provided under other sections.

B. Related Sections:
   1. NONE

1.2 REFERENCES

A. American Bearing Manufacturers Association:
   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.

C. International Electrical Testing Association:
   1. NETA ATS – Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

B. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

C. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

A. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
   1. Voltage: As indicated on Drawings.
   2. Service Factor: 1.15 or as provided by equipment manufacturer.
   3. Enclosure: Meet conditions of installation..
   4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   5. Insulation System: NEMA Class F for chillers, class B for pumps, fans, and other equipment..

6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid-state control relay with wiring to terminal box.
8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Stamp bearing sizes on nameplate.
9. Sound Power Levels: Conform to NEMA MG 1.

B. Single Phase Motors:
1. Electronically commutated (EC) type where available, otherwise use permanent split-capacitor (PSC) type motor.
2. Voltage: As indicated on Drawings, single phase, 60 Hz.

C. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned motors.

B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.

3.2 INSTALLATION

A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

B. Install engraved plastic nameplates in accordance with Division 26.

C. Ground and bond motors in accordance with Division 26.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.15.

END OF SECTION

SECTION 23 05 16 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flexible pipe connectors.
   2. Expansion joints.
   3. Expansion compensators.
   4. Pipe alignment guides.
   5. Swivel joints.
   6. Pipe anchors.

B. Related Sections:
   1. Section 21 05 00 – Common Work Results for Fire Suppression: Product and installation requirements for piping hangers and supports.
   2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for piping hangers and supports.
   3. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product and installation requirements for piping hangers and supports.
   4. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product and installation requirements for vibration isolators used in piping systems.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
   3. ASME B31.9 - Building Services Piping.
   4. ASME BPVC Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:
   1. Tepid Water Systems (Including Division 21 and 22)
      a. Expansion:
         1) Minimum Installation Temperature: 40 degrees F.
         2) Maximum System Temperature: 90 degrees F.
      b. Contraction:
         1) Maximum Installation Temperature: 85 degrees F.
         2) Minimum System Temperature: 35 degrees F.
      c. Safety Factor: 30 percent.
   2. Hot Water Systems (Including Division 22):
      a. Installation Temperature: 40 degrees F.
      b. Maximum System Temperature: 210 degrees F.
      c. Safety Factor: 30 percent.
   3. Chilled Water Systems:

a. Installation Temperature: 85 degrees F.
b. Minimum System Temperature: 40 degrees F.
c. Safety Factor: 30 percent.

4. Refrigerant Piping Systems:
   a. Liquid Line
      1) Installation Temperature: 40 degrees F.
      2) Maximum System Temperature: 120 degrees F.
   b. Suction Line
      1) Installation Temperature: 85 degrees F.
      2) Minimum System Temperature: 40 degrees F.
   c. Safety Factor: 30 percent.
5. Fuel Piping Systems:
   a. Exterior:
      1) Installation Temperature: 85 degrees F.
      2) Minimum System Temperature: -20 degrees F.
   b. Safety Factor: 30 percent.

1.5 SUBMITTALS

A. Design Data: Indicate criteria and show calculations.

B. Manufacturer's Installation Instructions: Submit special procedures.

C. Welders' Certificate: Include welders' certification of compliance with ASME BPVC Section IX, AWS D1.1/D1.1M, or equivalent.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

B. Operation and Maintenance Data: Submit adjustment instructions.

1.7 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with ASME B31.9 (and ASME B31.1 and ASME B31.5 as applicable) code for installation of piping systems and ASME Section BPVC IX for welding materials and procedures.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

B. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

A. Furnish five-year manufacturer warranty for leak free performance of packed expansion joints.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Steel Piping:
   1. Inner Hose: Carbon Steel or Stainless Steel.
   2. Exterior Sleeve: Double braided or stainless steel.
   3. Pressure Rating:
      a. Steam Systems: 125 psig WSP and 450 degrees F
      b. Hydronic, Fuel, and Refrigerant Systems: 200 psig WOG and 250 degrees F
   4. Joint: As specified for pipe joints.
   5. Size: Use pipe-sized units.
   6. Maximum offset: 1 inch on each side of installed centerline.

B. Copper Piping:
   1. Inner Hose: Bronze
   2. Exterior Sleeve: Braided bronze.
   3. Pressure Rating:
      a. Steam Systems: 125 psig WSP and 450 degrees F
      b. Hydronic, Fuel, and Refrigerant Systems: 200 psig WOG and 250 degrees F
   4. Joint: As specified for pipe joints.
   5. Size: Use pipe sized units
   6. Maximum offset: 1 inch on each side of installed center line

2.2 EXPANSION JOINTS

A. Single or Double Sphere, Elbow or Flexible Compensators:
   1. Body: Teflon or Neoprene and nylon.
   2. Pressure Rating:
      a. Steam Systems: 125 psig WSP and 450 degrees F
      b. Hydronic, Fuel, and Refrigerant Systems: 200 psig WOG and 250 degrees F
   3. Maximum Compression: 1 inch.
   4. Maximum Elongation: 1/2 inch.
   5. Maximum Offset: 3/4 inch.
   6. Maximum Angular Movement: 30 degrees.
   7. Joint: Galvanized flanges or unions.
   8. Size: Use pipe sized units
   9. Accessories: Control rods or control cables, as required.
   10. Application: Steel piping 2 inch and larger.

B. Copper with Packed Sliding Sleeve:
   1. Maximum Temperature: 250 degrees F.
   2. Joint: As specified for pipe joints.
   3. Size: Use pipe sized units
   4. Copper or steel piping 2 inches and larger.
   5. Application: Copper or steel piping 2 inch and larger.

2.3 ACCESSORIES

A. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1-inch thick insulation, minimum 3 inch travel.

B. Swivel Joints: Fabricated steel, bronze, ductile iron, or cast steel body, double ball bearing race, field lubricated, with rubber (Buna-N) O-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install Work in accordance with ASME B31.9 (and ASME B31.1 and ASME B31.5 as applicable).

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Section 23 05 48. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

D. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

E. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 23 05 29 (or 21 05 00 or 22 05 29 as applicable) for pipe hanger installation requirements.

F. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

3.2 MANUFACTURER'S FIELD SERVICES

A. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING & EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Equipment curbs.
6. Sleeves.
7. Mechanical sleeve seals.
8. Formed steel channel.
9. Firestopping relating to HVAC work.
10. Firestopping accessories.
11. Equipment bases and supports.

B. Related Sections:
1. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product and execution requirements for hanger and firestopping accessories.
2. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.
3. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product and execution requirements for vibration isolators.
4. Section 23 11 13 - Facility Fuel-Oil Piping: Execution requirements for placement of hangers and supports specified by this section.
5. Section 23 11 23 - Facility Natural-Gas Piping: Execution requirements for placement of hangers and supports specified by this section.
6. Section 23 21 13 - Hydronic Piping: Execution requirements for placement of hangers and supports specified by this section.
7. Section 23 22 13 - Steam and Condensate Heating Piping: Execution requirements for placement of hangers and supports specified by this section.
8. Section 23 24 16 - Internal-Combustion Engine Exhaust Piping: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method of Fire Tests of Penetration Firestop Systems.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. American Welding Society:
1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

D. FM Global:
1. FM Approvals - Approval Guide.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design Manufacturer, Selection, Application, and Installation.
2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
1. UL 263 - Standard for Fire Tests of Building Construction and Materials.
2. UL 723 - Standard for Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Standard for Fire Tests of Through-Penetration Firestops.
4. UL Directory – Certifications Directory - Fire–Resistance-Rated Systems and Products.

G. Intertek Testing Services (Warnock Hersey Mark):
1. WH Directory - Warnock Hersey (WH) Mark Directory.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. NONE.

1.5 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with AWS D1.1/D1.1M for welding hanger and support attachments to building structure.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience .

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Anvil International (Mueller Water Products, Inc.).
2. Carpenter & Paterson Inc.
3. Creative Systems Inc.
4. Flex-Weld, Inc.
5. Globe Pipe Hanger Products Inc.
6. Michigan Hanger Co.
7. Superior Valve Co.

B. Hydronic Piping:

1. Conform to MSS SP-69.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable, clevis.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 Inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, carbon steel ring.
16. Plastic Pipe Support: rubber-lined or felt-lined clamps. Tape-lined on non-clamping hangers.
17. For Exterior and Humid Areas: Furnished hot-dipped galvanized or Type 304 stainless steel or better hangers, support, and hardware.

C. Refrigerant Piping:
1. Conform to MSS SP-69.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, or Carbon steel, adjustable, clevis.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated carbon-steel ring.
10. For Exterior and Humid Areas: Furnished hot-dipped galvanized or Type 304 stainless steel or better hangers, support, and hardware.

D. Natural Gas Piping:
1. Conform to MSS SP-69.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable, clevis.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, carbon steel ring.

2.2 HANGER RODS

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Refer to Section 22 05 29.

2.4 FLASHING

A. Refer to Division 07

2.5 EQUIPMENT CURBS

A. Fabrication: Welded 18-gauge galvanized steel shell and base, mitered 3-inch cant, variable step to match roof insulation, factory installed wood nailer.

2.6 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick or Schedule 40 galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Walls: Steel pipe or 18 gage or Schedule 40 thick galvanized steel.

C. Sleeves for Pipes Through Beams and Footings: Steel pipe or 18 gage or Schedule 40 thick galvanized steel.

D. Sleeves for Round Ductwork: Galvanized steel.

E. Sleeves for Rectangular Ductwork: Galvanized steel.

F. Sealant: Acrylic.

2.7 MECHANICAL SLEEVE SEALS

A. Refer to Section 22 05 29.

2.8 FORMED STEEL CHANNEL

A. Refer to Section 22 05 29.

2.9 FIRESTOPPING

A. Refer to Division 07.

2.10 FIRESTOPPING ACCESSORIES

A. Refer to Division 07.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Obtain permission from Architect/Engineer before using powder-actuated anchors.

B. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Refer to Section 22 05 29 for installation requirements.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Refer to Section 22 05 29 for installation requirements.

B. Support piping as per Schedule included in this Section.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.
   1. Boiler Applications: Housekeeping pad shall 2 inches beyond the boiler panel in front of the boiler, 2 inches beyond the sides, and 12 inches beyond the rear of the unit.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - FLASHING

A. Refer to Division 07.

3.7 INSTALLATION - SLEEVES

A. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

B. Refer to Section 22 05 29 for additional installation requirements.

3.8 INSTALLATION - FIRESTOPPING

A. Install firestopping material at fire and smoke-rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items that require firestopping.

B. Refer to Division 07.

3.9 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.10 SCHEDULES

A. Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HORIZONTAL SPACING Feet	MAXIMUM VERTICAL SPACING Feet
ABS pipe	4	10 (note 2)
Aluminum pipe and tubing	10	15
Brass pipe	10	10
Brass tubing, 1-1/4-inch diameter and smaller	6	10
Brass tubing, 1-1/2-inch diameter and larger	10	10
Cast-iron pipe	5 (note 1)	15
Copper or copper-alloy pipe	12	10
Copper or copper-alloy tubing, 1-1/4-inch diameter and smaller	6	10
Copper or copper-alloy tubing, 1-1/2-inch diameter and larger	10	10
CPVC pipe or tubing, 1 inch and smaller	3	10 (note 2)

CPVC pipe or tubing, 1-1/4-inch and larger	4	10 (note 2)
Lead pipe	Continuous	4
PB pipe or tubing	32 inches	4
PEX tubing	32 inches	10 (note 2)
Polypropylene (PP) pipe or tubing, 1 inch or smaller	32 inches (note 3)	10 (note 2)
Polypropylene (PP) pipe or tubing, 1-1/4-inch or larger	4 (note 3)	10 (note 2)
PVC pipe	4	10
Steel tubing	8	10
Steel pipe	12	15

B. Note 1: The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.

C. Note 2: Mid-story guide (sliding point) required.

D. Note 3: Hanger spacing may be increased per piping manufacturer's installation instructions.

END OF SECTION

SECTION 23 05 48 - VIBRATION & SEISMIC CONTROLS FOR HVAC PIPING & EQPT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Inertia bases.
   2. Vibration isolators.

B. Related Sections:
   1. Section 21 05 00 – Common Work Results for Fire Suppression: Product requirements for pipe hangers and supports.
   2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports.
   3. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Product requirements for anchors and piping expansion compensation.
   4. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports.
   5. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section.
   6. Section 23 33 00 - Air Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

B. American National Standards Institute:
   1. ANSI S1.4 - American National Standard Specification for Sound Level Meters.
   2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
   3. ANSI S1.13 - Measurement of Sound Pressure Levels in Air.
   4. ANSI S12.60 – American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools.

C. Air Conditioning, Heating, & Refrigeration Institute:
   1. AHRI 575 - Method of Measuring Machinery Sound Within an Equipment Space.

D. American Society of Heating, Refrigerating and:
   1. ASHRAE 68 - Laboratory Method of Testing to Determine the Sound Power in a Duct.
   2. ASHRAE Handbook - HVAC Applications.

E. ASTM International:
   1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   2. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
   3. ASTM E596 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures.

F. International Organization for Standardization:
   1. ISO 3747 - Determination of Sound Power Levels and Sound Energy Levels of Noise Sources Using Sound Pressure - Engineering/Survey Methods for use in Situ in a Reverberant Environment.

G. Sheet Metal and Air Conditioning Contractors':
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping and ductwork.

B. Provide minimum static deflection of isolators for equipment per Vibration Isolation Schedule at end of Section.

C. Consider upper floor locations critical unless otherwise indicated.

D. Use concrete inertia bases for fans having static pressure in excess of 3.5 inches water column or motors in excess of 40 hp, and on base mounted pumps over 10 hp.

E. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.

F. Maintain rooms at following maximum sound levels, in Room Criteria (RC) as defined by ASHRAE Handbook., HVAC Applications and ANSI S1.8. See Room Sound Level Schedule at end of Section.

1.5 SUBMITTALS

A. Shop Drawings: Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.

B. Test Reports: Indicate dynamic insertion loss and noise generation values of silencers. Acoustic housings meet or exceed specified sound transmission loss values.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of hangers including attachment points.

1.7 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with ANSI S1.13 and AHRI 575 standards and recommendations of ASHRAE 68.

C. Duct Silencer: Silencer performance must have been substantiated by laboratory testing in a duct-to-reverberant room test facility according to ASTM E477

D. School Buildings: Perform Work in accordance with ANSI S12.60 standard.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 INERTIA BASES

A. Selection:
   1. Specific equipment base requirements per Base Schedule at the end of this Section.

B. No Base (Type A):

1. Construction: Isolators attached directly to equipment.

C. Structural Bases (Type B):
1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
2. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.

D. Concrete Inertia Bases (Type C):
1. Mass: Minimum of 1.5 times weight of isolated equipment.
2. Construction: Structured steel channel perimeter frame, with gusset brackets and anchor bolts, adequately reinforced, concrete filled.
3. Connecting Point: Reinforced to connect isolators and snubbers to base.
4. Concrete: Reinforced 3,000-psi concrete.

E. Curb-Mounted Base (Type D):
1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
2. Construction: Welded structural steel with gusset brackets, supporting equipment, with watertight assembly. Airside equipment shall have airtight assembly.
3. Coordination: Coordinate size and location with architectural roof curb.

2.2 VIBRATION ISOLATORS

A. Selection:
1. Specific equipment isolator and deflection requirements per Isolator Schedule at the end of this Section.

B. Neoprene Pad Isolators (Type 1):
1. Rubber or neoprene-waffle pads.
a. 30 durometer minimum.
b. Minimum 1/2 inch thick.
c. Maximum loading 40 psi.
d. Height of ribs: not to exceed 0.7 times width.
2. Configuration: Single layer or 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

C. Glass Fiber Pads (Type 1): Neoprene jacketed pre-compressed molded glass fiber.

D. Rubber Mount or Hanger (Type 2): Molded rubber with threaded insert.

E. Open Spring Isolators (Type 3):
1. Spring Isolators:
a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
b. Code: Color code springs for load carrying capacity.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Spring Mounts: Furnish with leveling devices, minimum 0.25-inch thick neoprene sound pads, and zinc chromate plated hardware.
4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

F. Closed Spring Isolators (Type 3):
1. Spring Isolators:
a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
b. Code: Color code springs for load carrying capacity.

2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance.

G. Spring Hanger (Type 3):
1. Spring Isolators:
   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators or rubber hanger with threaded insert.
4. Misalignment: Capable of 20-degree hanger rod misalignment.

H. Restrained Spring Isolators (Type 4):
1. Spring Isolators:
   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Spring Mounts: Furnish with leveling devices, minimum 0.25-inch thick neoprene sound pads, and zinc chromate plated hardware.
4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
5. Restraint: Furnish mounting frame and limit stops.

I. Restrained Closed Spring Isolators (Type 4):
1. Spring Isolators:
   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.
2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance and limit stops.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify equipment, ductwork and piping is installed before work in this section is started.

3.2 EXISTING WORK

A. Provide access to existing piping and ductwork and other installations remaining active and requiring access.

B. Extend existing piping and ductwork installations using materials and methods.

3.3 INSTALLATION – VIBRATION ISOLATION

A. Support duct silencers independent of ductwork. Refer to Section 23 33 00.

B. Install isolation for motor driven equipment.

C. Bases:
   1. Set steel bases for 1 inch clearance between housekeeping pad and base.
   2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.

D. Adjust equipment level.

E. Install spring hangers without binding.

F. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

G. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

H. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.

I. Support piping connections to isolated equipment resiliently as follows:
   1. Suspended piping: All piping in mechanical rooms and within 50 feet of vibration-isolated equipment.
   2. Select three hangers closest to vibration source for minimum static deflection equivalent to isolated equipment deflection, with a 2-inch maximum. Select remaining isolators for minimum 0.75-inch static deflection.
   3. Suspended piping: Suspended below or within 50 feet of noise-sensitive areas.

J. Piping over 2-inch diameter suspended below or within 50 feet of noise-sensitive areas shall be hung with isolation hangers.

3.4 INSTALLATION – ACOUSTICAL PERFORMANCE

A. School Buildings: Perform Work in accordance with ANSI S12.60 standard.

3.5 SCHEDULES

A. Room Sound Level:

Room Types	Description	Noise/Room Criterion (NC/RC)
Residences	Living areas	30
	Bathrooms, kitchens, utility	35
Hotels	Individual rooms	30
	Meeting/banquet rooms	30
	Corridors and lobbies	40
	Service/support areas	40
Office Buildings	Executive and private offices	30
	Conference rooms	30
	Teleconference rooms	25
	Open-plan offices	40
	Corridors and lobbies	40

Room Types	Description	Noise/Room Criterion (NC/RC)
Courtrooms	Unamplified speech	30
	Amplified speech	35
Performing Arts Spaces	Drama theaters, concert and recital halls	20
	Music teaching studios	25
	Music practice rooms	30
Hospitals and Clinics	Patient rooms	30
	Wards	35
	Operating and procedure rooms	35
	Corridors and lobbies	40
Laboratories	Testing/research with minimal speech communication	50
	Extensive phone use and speech communication	45
	Group teaching	35
Religious	General assembly with critical music programs	25
Schools	Classrooms – K-8	30
	Classrooms – secondary and post-secondary	30
	Large lecture rooms with speech amplification	30
	Large lecture rooms without speech amplification	25
Libraries		30
Indoor Stadiums, Gymnasiums	Gymnasiums and natatoriums	45
	Large-seating-capacity spaces with speech amplification	50

B. Pipe Isolation Schedule:

Pipe Size Inch	Isolated Distance from Equipment diameters
1	120
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters
8	60 diameters
10	54 diameters
12	50 diameters
16	45 diameters
24	38 diameters

C. Equipment Isolation Schedule:

Isolated Equipment	Slab on Grade		Floor Span Up to 20 ft		Floor Span 20 to 30 ft		Floor Span 30 to 40 ft	
	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)
Air Compressors and Vacuum Pumps								
Tank-mounted horz., ≤ 10 HP	A-3	0.75	A-3	0.75	A-3	1.50	A-3	1.50
Tank-mounted horz., ≥ 15 HP	C-3	0.75	C-3	0.75	C-3	1.50	C-3	1.50
Tank-mounted vert.	C-3	0.75	C-3	0.75	C-3	1.50	C-3	1.50
Base-mounted	C-3	0.75	C-3	0.75	C-3	1.50	C-3	1.50
Large reciprocating	C-3	0.75	C-3	0.75	C-3	1.50	C-3	1.50
Pumps								
Closed-coupled, ≤ 7.5 HP	B-2	0.25	C-3	0.75	C-3	0.75	C-3	0.75
Closed-coupled, ≥ 10 HP	C-3	0.75	C-3	0.75	C-3	1.50	C-3	1.50
Inline, ≤25 HP	A-3	0.75	A-3	1.50	A-3	1.50	A-3	1.50
Inline, ≥30 HP	A-3	1.50	A-3	1.50	A-3	1.50	A-3	2.50
Packaged pump systems	A-3	0.75	A-3	0.75	A-3	1.50	C-3	2.50
Axial Fans, Plenum Fans, Cabinet Fans, Fan Sections, Centrifugal Inline Fans								
≤ 22-inch diameter	A-2	0.25	A-3	0.75	A-3	0.75	C-3	0.75
≥ 24-inch diameter, ≤ 2-in. SP HP, ≤300 RPM	B-3	2.50	C-3	3.50	C-3	3.50	C-3	3.50
≥ 24-inch diameter, ≤ 2-in. SP, 301 to 500 RPM	B-3	0.75	B-3	1.50	C-3	2.50	C-3	2.50
≥ 24-inch diameter, ≤ 2-in. SP HP, ≥ 500 RPM	B-3	0.75	B-3	1.50	B-3	2.50	B-3	2.50
≥ 24-inch diameter, > 2-in. SP, ≤ 300 RPM	C-3	2.50	C-3	3.50	C-3	3.50	C-3	3.50
≥ 24-inch diameter, > 2-in. SP, 301 to 500 RPM	C-3	1.50	C-3	1.50	C-3	2.50	C-3	2.50
≥ 24-inch diameter, > 2-in. SP, ≥ 500 RPM	C-3	0.75	C-3	1.50	C-3	1.50	C-3	2.50
Centrifugal Fans								
≤ 22-inch diameter	B-2	0.25	B-3	0.75	B-3	0.75	B-3	1.50

Isolated Equipment	Slab on Grade		Floor Span Up to 20 ft		Floor Span 20 to 30 ft		Floor Span 30 to 40 ft	
	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)
≥ 24-inch diameter, ≤ 40 HP, ≤ 300 RPM	B-3	2.50	B-3	3.50	B-3	3.50	B-3	3.50
≥ 24-inch diameter, ≤ 40 HP, 301 to 500 RPM	B-3	0.75	B-3	1.50	B-3	2.50	B-3	2.50
≥ 24-inch diameter, ≤ 40 HP, ≥ 500 RPM	B-3	0.75	B-3	0.75	B-3	0.75	B-3	1.50
≥ 24-inch diameter, ≥ 50 HP, ≤ 300 RPM	C-3	2.50	C-3	3.50	C-3	3.50	C-3	3.50
≥ 24-inch diameter, ≥ 50 HP, 301 to 500 RPM	C-3	1.50	C-3	1.50	C-3	2.50	C-3	2.50
≥ 24-inch diameter, ≥ 50 HP, ≥ 500 RPM	C-3	1.00	C-3	1.50	C-3	1.50	C-3	2.50
Propeller Fans								
Wall-mounted	A-1	0.25	A-1	0.25	A-1	0.25	A-1	0.25
Roof-mounted	A-1	0.25	A-1	0.25	B-4	1.50	D-3	3.50
Heat Pumps, Fan-Coils, Computer Room Units								
All	A-3	0.75	A-3	0.75	A-3	0.75	A/D-3	1.50
Condensing Units								
All	A-1	0.25	A-4	0.75	A-4	1.50	A/D-4	1.50
Packaged AH, AC, H, and V Units								
≤ 10 HP	A-3	0.75	A-3	0.75	A-3	0.75	A-3	0.75
≤ 15 HP *and* ≤ 4-in. SP, ≤ 300 RPM	A-3	0.75	A-3	3.50	A-3	3.50	C-3	3.50
≤ 15 HP *and* ≤ 4-in. SP, 301 to 500 RPM	A-3	0.75	A-3	2.50	A-3	2.50	A-3	2.50
≤ 15 HP *and* ≤ 4-in. SP, ≥ 500 RPM	A-3	0.75	A-3	1.50	A-3	1.50	A-3	1.50
≥ 15 HP *or* ≥ 4-in. SP, ≤ 300 RPM	B-3	0.75	C-3	3.50	C-3	3.50	C-3	3.50
≥ 15 HP *or* ≥ 4-in. SP, 301 to 500 RPM	B-3	0.75	C-3	1.50	C-3	2.50	C-3	2.50
≥ 15 HP *or* ≥ 4-in. SP, ≥ 500 RPM	B-3	0.75	C-3	1.50	C-3	1.50	C-3	2.50
Packaged Rooftop Equipment								
All	A-1	0.25	A-4	0.75	A-4	1.50	A/D-4	1.50

Isolated Equipment	Slab on Grade		Floor Span Up to 20 ft		Floor Span 20 to 30 ft		Floor Span 30 to 40 ft	
	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)	Base & Isolator Type[1]	Min. Defl. (In.)
Ducted Rotating Equipment – Small Fans, Fan-Powered Boxes								
≤ 600 CFM	A-3	0.50	A-3	0.50	A-3	0.50	A-3	0.50
> 600 CFM	A-3	0.75	A-3	0.75	A-3	0.75	A-3	0.75

Note 1: Base type and isolator type correspond with equipment listed in Part 2 of this Section.

END OF SECTION

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SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Pipe markers.
   5. Ceiling tacks.
   6. Labels.
   7. Lockout devices.

B. Related Sections:
   1. NONE.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. NONE.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags:

1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches square.

B. Metal Tags:
1. Brass, Aluminum, or Stainless Steel with stamped letters; tag size minimum 1-1/2 inches square with finished edges.

C. Information Tags:
1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum or plastic laminated frame.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
4. Ductwork and Equipment: 1-3/4 inches high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PLASTIC MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Markers:
1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Markers:
1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Markers:
1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4-mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

A. Description: Steel or plastic with 3/4 inch diameter color-coded head.

B. Color code as approved by Owner. If no preference by Owner, color as follows:
1. HVAC equipment (including terminal boxes): Yellow.
2. Fire dampers/smoke dampers: Red.
3. Plumbing valves: Green.
4. Heating/cooling valves: Blue.

C. Contractor Option: Adhesive stickers may be used in lieu of tacks.

2.6 LABELS

A. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:
1. Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:

1. Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units, zone dampers, and radiator valves with numbered tags corresponding to Drawings.

J. Identify space temperature sensors with tags indicating HVAC unit and air terminal unit (if applicable) served.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with plastic markers, or plastic tape markers,.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification:
      a. Not to exceed 20 feet on straight runs including risers and drops.
      b. Adjacent to each valve and tee.
      c. At each side of penetration of structure or enclosure.
      d. At each obstruction.

M. Identify ductwork with plastic tape markers.
   1. Identify with air handling unit identification number, area served, and flow direction.
   2. Locate identification:
      a. At air handling unit.
      b. At each side of penetration of structure or enclosure.
      c. At each obstruction.

N. Provide ceiling tacks to locate valves, dampers, and terminal boxes above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing, adjusting, and balancing of air systems.
   2. Testing, adjusting, and balancing of hydronic systems.
   3. Measurement of final operating condition of HVAC systems.

B. Related Sections:
   1. Section 23 09 23 - Direct-Digital Control System for HVAC: Requirements for coordination between DDC system and testing, adjusting, and balancing work.
   2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation for HVAC equipment.

1.2 REFERENCES

A. Associated Air Balance Council:
   1. AABC - National Standards for Total System Balance.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 111 - Measurement, Testing, Adjusting and Balancing of Building HVAC Systems.

C. Natural Environmental Balancing Bureau:
   1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

D. Testing, Adjusting and Balancing Bureau:
   1. TABB – International Standards for Environmental Systems Balance.

1.3 SYSTEM DESCRIPTION

A. The Work in this Section shall be by the Testing and Balancing Contractor (TAB) as a sub-contractor to the Mechanical Contractor. The TAB shall be a third party to the Mechanical Contractor.

B. Existing Buildings: The Scope of TAB Work is to include the entire building, including areas labeled as Not-In-Contract in the Drawings unless specifically noted below.
   1. Existing AHUs 11, 20, 21, 22, and 23 may be excluded from the TAB scope as no work is being done to these systems or the areas they serve.
   2. Existing AHU-25, which serves the EMT Lab may be excluded from this scope as TAB will be performed as part of the EMT Lab remodel.
   3. All exhaust fans shall be included as scope for bidding purposes, however a cost deduct per existing to remain exhaust fan and an expected total quantity to be excluded from scope of TAB should be provided.

1.4 SUBMITTALS

A. Test Reports: Indicate data on AABC, ASHRAE 111, NEBB, or TABB/SMACNA Report forms.

B. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

C. Furnish reports in soft cover, letter size manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of flow measuring stations, balancing valves, and rough setting.

B. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with AABC, ASHRAE 111, NEBB, or TABB standards.

C. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.7 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience certified by AABC, NEBB, or TABB.

B. Company shall be third party and independent of Mechanical Contractor.

1.8 SEQUENCING

A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.9 WARRANTY

A. Provide warranty for period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10% of total number of terminals, or resetting of any outlet, coil, or device listed in the test report.

B. Warranty shall meet the requirements of the following programs:
1. AABC – National Project Performance Guarantee
2. NEBB – Conformance Certification
3. TABB – International Quality Assurance Program

PART 2 PRODUCTS

2.1 NONE

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to verify required balancing devices are shown and in accessible locations.

B. Examine approved HVAC system equipment submittals.

C. Verify systems are complete and operable before commencing work. Verify the following:
1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.

13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place or in normal position.
15. Service and balancing valves are open.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus 10 or minus 5 percent of design.
   1. Outside air shall NOT be less than the design value.

B. Air Outlets and Inlets:
   1. Total for Space: Adjust to within plus 10 or minus 5 percent of design.
   2. Each Inlet and Outlet: Adjust to within plus 10 or minus 5 percent of design.

C. Hydronic Systems: Adjust to within plus 10 or minus 5 percent of design.

3.4 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

D. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

G. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.
   1. Fans with VFDs: Lockout resonant frequencies that generate excessive noise or vibration. Refer to Section 23 05 53.
   2. Belt Driven Fans: Provide sheave drive changes to vary fan speed.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries .

M. Assist Temperature Controls Contractor (TCC) in calibrating flow monitoring stations, variable frequency drives, and static pressure setpoint.

N. Measure static pressure at the most critical terminal unit and adjust the primary supply air static pressure controller to ensure the minimum static pressure is maintained, as defined by the terminal unit manufacturer.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems, after air balancing, to obtain design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.

C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

G. Variable Speed Systems:
   1. Assist Temperature Controls Contractor (TCC) with establishing the correct pressure control set point.
   2. Pumps with VFDs: Lockout resonant frequencies that generate excessive noise or vibration. Refer to Section 23 05 53.

3.7 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Plumbing Pumps.
   2. Boiler Pumps.
   3. HVAC Pumps.
   4. Packaged Makeup Air Units.
   5. Air Coils.
   6. Evaporative Humidifier.
   7. Terminal Heat Transfer Units.
   8. Induction Units.

9. Fan Coil Units.
10. Air Handling Units.
11. Fans.
12. Air Filters.
13. Air Terminal Units.
14. Air Inlets and Outlets.
15. Kitchen hood supply systems.
16. Kitchen hood exhaust systems.

B. Report Forms
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
      d. Project name
      e. Project location
      f. Project Architect
      g. Project Engineer
      h. Project Contractor
      i. Project altitude
      j. Report date
   2. Summary Comments:
      a. Design versus final performance
      b. Notable characteristics of system
      c. Description of systems operation sequence
      d. Summary of outdoor and exhaust flows to indicate building pressurization
      e. Nomenclature used throughout report
      f. Test conditions
   3. Instrument List:
      a. Instrument
      b. Manufacturer
      c. Model number
      d. Serial number
      e. Range
      f. Calibration date
   4. Electric Motors:
      a. Manufacturer
      b. Model/Frame
      c. HP/BHP and kW
      d. Phase, voltage, amperage; nameplate, actual, no load
      e. RPM
      f. Service factor
      g. Starter size, rating, heater elements
      h. Sheave Make/Size/Bore
   5. V-Belt Drive:
      a. Identification/location
      b. Required driven RPM
      c. Driven sheave, diameter and RPM
      d. Belt, size and quantity
      e. Motor sheave diameter and RPM
      f. Center to center distance, maximum, minimum, and actual
   6. Pump Data:
      a. Identification/number

b. Manufacturer
c. Size/model
d. Impeller
e. Service
f. Design flow rate, pressure drop, BHP and kW
g. Actual flow rate, pressure drop, BHP and kW
h. Discharge pressure
i. Suction pressure
j. Total operating head pressure
k. Shut off, discharge and suction pressures
l. Shut off, total head pressure

7. Cooling Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Entering air DB temperature, design and actual
   g. Entering air WB temperature, design and actual
   h. Leaving air DB temperature, design and actual
   i. Leaving air WB temperature, design and actual
   j. Water flow, design and actual
   k. Water pressure drop, design and actual
   l. Entering water temperature, design and actual
   m. Leaving water temperature, design and actual
   n. Saturated suction temperature, design and actual
   o. Air pressure drop, design and actual
8. Heating Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Water flow, design and actual
   g. Water pressure drop, design and actual
   h. Entering water temperature, design and actual
   i. Leaving water temperature, design and actual
   j. Entering air temperature, design and actual
   k. Leaving air temperature, design and actual
   l. Air pressure drop, design and actual
9. Induction Unit Data:
   a. Manufacturer
   b. Identification/number
   c. Location
   d. Model number
   e. Size
   f. Design air flow
   g. Design nozzle pressure drop
   h. Final nozzle pressure drop
   i. Final air flow
10. Air Moving Equipment:
    a. Location
    b. Manufacturer

c. Model number
d. Serial number
e. Arrangement/Class/Discharge
f. Air flow, specified and actual
g. Return air flow, specified and actual
h. Outside air flow, specified and actual
i. Total static pressure (total external), specified and actual
j. Inlet pressure
k. Discharge pressure
l. Sheave Make/Size/Bore
m. Number of Belts/Make/Size
n. Fan RPM

11. Return Air/Outside Air Data:
    a. Identification/location
    b. Design air flow
    c. Actual air flow
    d. Design return air flow
    e. Actual return air flow
    f. Design outside air flow
    g. Actual outside air flow
    h. Return air temperature
    i. Outside air temperature
    j. Required mixed air temperature
    k. Actual mixed air temperature
    l. Design outside/return air ratio
    m. Actual outside/return air ratio
12. Exhaust Fan Data:
    a. Location
    b. Manufacturer
    c. Model number
    d. Serial number
    e. Air flow, specified and actual
    f. Total static pressure (total external), specified and actual
    g. Inlet pressure
    h. Discharge pressure
    i. Sheave Make/Size/Bore
    j. Number of Belts/Make/Size
    k. Fan RPM
13. Duct Traverse:
    a. System zone/branch
    b. Duct size
    c. Area
    d. Design velocity
    e. Design air flow
    f. Test velocity
    g. Test air flow
    h. Duct static pressure
    i. Air temperature
    j. Air correction factor
14. Flow Measuring Station:
    a. Identification/number
    b. Location
    c. Size

d. Manufacturer
e. Model number
f. Serial number
g. Design Flow rate
h. Design pressure drop
i. Actual/final pressure drop
j. Actual/final flow rate
k. Station calibrated setting

15. Terminal Unit Data:
    a. Manufacturer
    b. Type, constant, variable, single, dual duct
    c. Identification/number
    d. Location
    e. Model number
    f. Size
    g. Minimum static pressure
    h. Minimum design air flow
    i. Maximum design air flow
    j. Maximum actual air flow
    k. Inlet static pressure

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Piping system insulation.
   2. Equipment insulation.
   3. Pipe insulation jackets.
   4. Equipment insulation jackets.
   5. Insulation accessories including vapor retarders and accessories.
   6. Ductwork insulation.
   7. Ductwork insulation jackets.
   8. Duct liner.
   9. Insulation accessories including vapor retarders and accessories.

B. Related Sections:
   1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product and Execution requirements for inserts at hanger locations.
   2. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for HVAC piping and equipment identification.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   2. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   3. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   4. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
   5. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
   6. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
   7. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
   8. ASTM E84 – Standard for Test for Surface Burning Characteristics of Building Materials.
   9. ASTM E96/E96M - Standard Test Method for Water Vapor Transmission of Materials.

B. Sheet Metal and Air Conditioning Contractors' National Association:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. National Fire Protection Association (NFPA).

D. Underwriter's Laboratories (UL).
   1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

E. 2015 MN Commercial Energy Code.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. Product Data: Submit product description, thermal characteristics, and list of materials and thickness for each service, and location.

1.5 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

B. Maintain temperature during and after installation for minimum period as recommended by manufacturer.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Armacell, LLC (Armaflex).

B. Aeroflex USA, Inc.

C. K-Flex USA.

D. Johns Manville.

E. Knauf Insulation.

F. Owens-Corning.

2.2 SURFACE BURNING CHARACTERISTICS

A. For all insulation and related materials, provide UL Classified products per UL 723 and/or meeting ASTM E84, by a testing agency acceptable to the authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

B. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.

C. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

2.3 PIPE: MAN MADE MINERAL FIBER

A. Insulation: ASTM C547 Mineral Fiber Pipe Insulation, Type I, 805 degrees F.

B. Applications on Austenitic stainless steel: Conform to ASTM C795.

C. Vapor Retarder Jacket:
   1. White Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E96/E96M; 0.02 perm-inches.

D. Vapor Retarder Lap Adhesive:
   1. Compatible with insulation.

2.4 DUCT: MINERAL FIBER, FLEXIBLE

A. Insulation: ASTM C553 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications, Type II.

B. Vapor Retarder Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E96/E96M; 0.02 perms.
   3. Secure with pressure sensitive tape.

C. Vapor Retarder Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.

2.5 DUCT: MINERAL FIBER, RIGID

A. Insulation: ASTM C612 Mineral Fiber Block and Board Insulation, Type IA.

B. Vapor Retarder Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E96/E96M; 0.04 perms.
   3. Secure with pressure sensitive tape.

C. Vapor Retarder Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.

D. Indoor Vapor Retarder Finish:
   1. Cloth: Untreated; 9 oz./sq. yd. weight, glass fabric.
   2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.6 REFRIGERANT PIPE: ELASTOMERIC CELLULAR FOAM

A. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534/C534M; Type I, Tubular form.

B. Elastomeric Foam Adhesive:
   1. Air-dried, contact adhesive, compatible with insulation.

2.7 JACKETS: PIPE INSULATION AND EQUIPMENT

A. PVC Plastic Pipe Jacket:
   1. Product Description: One-piece molded type fitting covers and sheet material, off-white color.
   2. Thickness: 10 mil.
   3. Connections: Brush on welding adhesive.

B. Covering Adhesive Mastic:
   1. Compatible with insulation.

2.8 DUCT LINER: ELASTOMERIC CELLULAR FOAM

A. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534/C534M; Type I, Tubular form

B. Elastomeric Foam Adhesive:

1. Air-dried, contact adhesive, compatible with insulation.

2.9 DUCT LINER: GLASS FIBER

A. Insulation: ASTM C1071 Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material), Type II.

B. Adhesive:
   1. Waterproof type.

C. Liner Fasteners: Galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping, equipment and ductwork has been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING

A. Exposed Piping: Locate insulation and cover seams in least visible locations.

B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, [pump bodies,] and expansion joints.

C. Manmade mineral fiber insulated pipes conveying fluids below ambient temperature:
   1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

E. Manmade mineral fiber insulated pipes conveying fluids above ambient temperature:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Inserts and Shields:
   1. Application: Piping or Equipment 2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under finish jacket.
   4. Insert configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be site fabricated or factory fabricated.
   5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.

G. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

H. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.

I. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel, or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

E. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

F. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

G. Mineral fiber insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor retarder, factory-applied or field-applied. Finish with glass cloth and adhesive.

H. Finish insulation at supports, protrusions, and interruptions.

I. Nameplates and ASME Stamps: Bevel and seal insulation around. Do not insulate over.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 INSTALLATION - DUCTWORK

A. Insulated ductwork conveying air below ambient temperature:
   1. Provide insulation with vapor retarder jackets.
   2. Finish with tape and vapor retarder jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

B. Insulated ductwork conveying air above ambient temperature:
   1. Provide with or without standard vapor retarder jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

C. External Duct Insulation Application:
   1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
   2. Secure insulation without vapor retarder with staples, tape, or wires.
   3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
   4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

D. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.

4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.5 SCHEDULES

A. Piping:
1. Heating Systems:
a. Heating Water Supply and Return:
1) Man Made Mineral Fiber Insulation:
a) Pipe Size Range: All.
b) Thickness: Per Pipe Insulation Schedule included in this Section.
2. Cooling Systems:
a. Chilled Water Supply and Return:
1) Man Made Mineral Fiber Insulation:
a) Pipe Size Range: All.
b) Thickness: Per Pipe Insulation Schedule included in this Section.
b. Refrigerant Suction: Elastomeric cellular foam – twin-tube, 1-inch thick.
c. Refrigerant Hot Gas: Elastomeric cellular foam – twin-tube, 1-inch thick.
d. Condensate Drains from Cooling Coils:
1) Man Made Mineral Fiber Insulation, 1-inch thick.
3. Other Systems:
a. Condensate Drains from Combustion Equipment: Not Required.

SCHEDULE OF MINIMUM PIPE INSULATION THICKNESS (IN INCHES)

Fluid Design Operating Temp Range	Nominal Pipe or Tube Size, in.				
	<1	1 – <1-1/2	1-1/2 – <4	4 - <8	=>8
Heating Systems (Steam, Steam Condensate, Hot Water)					
>350	4.5	5.0	5.0	5.0	5.0
251 – 350	3.0	4.0	4.5	4.5	4.5
201 – 250	2.5	2.5	2.5	3.0	3.0
141 – 200	1.5	1.5	2.0	2.0	2.0
105 – 140	1.0	1.0	1.5	1.5	1.5
<105	0.5	0.5	1.0	1.0	1.0
Cooling Systems (Refrigerant)					
>60	0.5	0.5	0.5	0.5	1.0
40 – 60	0.5	0.5	1.0	1.0	1.0
<40	0.5	1.0	1.0	1.0	1.5

B. Equipment:
1. Hydronic System Equipment:
a. Material: Elastomeric Cellular Foam.
1) Thickness: Per pipe insulation schedule. Select for rated temperature range with 2-inch equivalent pipe.
2) Applicable Equipment:
a) Air Separators.

C. Ductwork:
1. Supply and Return Ducts:
a. Insulation:
1) Material: Rigid (exposed, mech rooms) or flexible (concealed) glass fiber ductwork insulation.
2) Thickness: Per Duct Insulation Schedule included in this Section.
3) Vapor Retarder: Per Duct Insulation Schedule included in this Section.

4) Weatherproof Barrier: Per Duct Insulation Schedule included in this Section.

2. Transfer Air Duct:
   a. Duct Liner Material: Elastomeric cellular foam or glass fiber internal duct liner.
   b. Thickness: 1 inch thick.
3. Exhaust and Relief Ducts:
   a. Within 10 feet of Exterior Openings:
      1) Insulation Material: Flexible glass fiber ductwork insulation.
      2) Thickness: Per Duct Insulation Schedule included in this Section.
      3) Vapor Retarder: Required.
   b. Exposed to Outdoor Air:
      1) Insulation Material: Rigid glass fiber ductwork insulation.
      2) Thickness: Per Duct Insulation Schedule included in this Section.
      3) Vapor Retarder: Required.
      4) Weatherproof Barrier: Required.
   c. Other Exhaust Duct Locations:
      1) Insulation not required.
4. Outside Air Intake Ducts:
   a. Insulation Material: Rigid glass fiber ductwork insulation.
   b. Thickness: 1-1/2 inches thick.
   c. Vapor Retarder: Required.

MINIMUM REQUIRED DUCT INSULATION			
Duct Location	**Supply Duct**	**Return Duct**	**Exhaust Duct**
Exterior	R-12.0, V, W	R-12.0, V, W	R-12.0, V, W
Attics	R-12.0, V	R-12.0, V	R-6.0, V
Duct to Space delta-T: >40 degrees F	R-5.0, V	-	R-5.0, V
Duct to Space delta-T: 15-40 degrees F	R-3.3, V	-	R-3.3, V
Duct to Space delta-T: <15 degrees F	-	-	-
Within Conditioned Spaces	NOTE 3	-	-
Notes:			
1: V indicated Vapor Retarder			
2: W indicates Weatherproof Barrier			
3: If supply air temperature rise is greater than 3 degrees F, duct insulation is required.			

END OF SECTION

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SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. HVAC commissioning description.
   2. HVAC commissioning responsibilities.

B. Related Sections:

1.2 COMMISSIONING DESCRIPTION

A. HVAC commissioning process is by Commissioning Authority. This section discusses responsibility by other Contractor regarding the commissioning process.

B. HVAC commissioning process includes the following tasks:
   1. Testing and startup of HVAC equipment and systems.
   2. Equipment and system verification checks.
   3. Assistance in functional performance testing to verify testing and balancing, and equipment and system performance.
   4. Provide qualified personnel to assist in commissioning tests, including seasonal testing.
   5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
   6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
   7. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
   8. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
   9. Provide training for systems specified in this Section with coordination by Commissioning Authority.

C. Equipment and Systems to Be Commissioned:
   1. Chillers.
   2. Pumps.
   3. Boilers.
   4. Piping systems.
   5. Ductwork.
   6. Variable frequency drives.
   7. Gas-fired makeup air units.
   8. Humidifiers.
   9. Air handling units.
   10. Air handling unit duct systems.
   11. Hot water terminal heating equipment.
   12. Induction Units.
   13. Fan Coil Units.
   14. Unit heaters.
   15. Constant volume terminal units.
   16. Variable volume terminal units.
   17. Fans.
   18. Specialty fans.
   19. Fire dampers.
   20. Smoke dampers.

21. Indoor air quality.
22. Equipment sound control.
23. Equipment vibration control.
24. Kitchen hood supply systems.
25. Kitchen hood exhaust systems.
26. Automatic temperature control system.
27. Testing, Adjusting and Balancing work.

1.3 COMMISSIONING SUBMITTALS

A. Draft Forms: Submit draft of system verification form and functional performance test checklist.

B. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified. Use ACG or equivelent forms as guidelines.

C. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.

B. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASHRAE Guideline 1.

B. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.6 COMMISSIONING RESPONSIBILITIES

A. Mechanical Contractor Commissioning Responsibilities:
1. Attend commissioning meetings.
2. Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
3. Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
4. Provide instructions and demonstrations for Owner's personnel.
5. Ensure subcontractors perform assigned commissioning responsibilities.
6. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
7. Develop startup and initial checkout plan using manufacturer’s startup procedures and functional performance checklists for equipment and systems to be commissioned.
8. During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.
9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
10. Provide manufacturer’s representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
12. Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.

13. Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
15. Provide factory supervised startup services for all new or modified equipment and systems. Coordinate work with manufacturer and Commissioning Authority.
16. Perform verification checks and startup on equipment and systems as specified.
17. Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
18. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
19. Conduct HVAC system orientation and inspection.

B. Temperature Controls Contractor (TCC) Commissioning Responsibilities:
1. Attend commissioning meetings.
2. Review design for ability of systems to be controlled including the following:
    a. Confirm proper hardware requirements exists to perform functional performance testing.
    b. Confirm proper safeties and interlocks are included in design.
    c. Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
    d. Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.
    e. Confirm sensors selected are within device ranges.
    f. Review sequences of operation and obtain clarification from Architect/Engineer.
    g. Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.
    h. Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers' stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.
3. Inspect, check, and confirm proper operation and performance of control hardware and software provided in other HVAC sections.
4. Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Architect/Engineer.
5. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
6. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and requirements of 23 09 23.
7. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
8. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
9. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
10. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

C. Testing, Adjusting, and Balancing Contractor (TAB) Commissioning Responsibilities:
1. Attend commissioning meetings.
2. Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes. Repeat sample of 20 percent of measurements contained in testing, adjusting, and balancing report.

3. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.7 COMMISSIONING MEETINGS

A. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.8 SCHEDULING

A. Prepare schedule indicating anticipated start dates for the following:
   1. Piping system pressure testing.
   2. Piping system flushing and cleaning.
   3. Ductwork cleaning.
   4. Ductwork pressure testing.
   5. Equipment and system startups.
   6. Automatic temperature control system checkout.
   7. Testing, adjusting, and balancing.
   8. HVAC system orientation and inspections.
   9. Operation and maintenance manual submittals.
   10. Training sessions.

B. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.

C. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.9 COORDINATION

A. Notify Commissioning Authority minimum of four weeks in advance of the following:
   1. Scheduled equipment and system startups.
   2. Scheduled automatic temperature control system checkout.
   3. Scheduled start of testing, adjusting, and balancing work.

B. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 INSTALLATION

A. Install additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps required by Commissioning Authority.

B. Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.

C. Install replacement sheaves and belts to obtain system performance, as requested by Commissioning Authority.

D. Install test holes in ductwork and plenums as requested by Commissioning Authority for taking air measurements. Refer to Section 23 33 00.

E. Prior to start of functional performance test, install replacement filters in equipment [as specified in individual sections.

3.2 COMMISSIONING

A. Seasonal Sensitive Functional Performance Tests:
   1. Test heating equipment at winter design temperatures.
   2. Test cooling equipment at summer design temperatures.
   3. Participate in testing delayed beyond Final Completion to test performance at peak seasonal conditions.

B. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.

C. Occupancy Sensitive Functional Performance Tests:
   1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.
   2. Participate in testing delayed beyond Final Completion to test performance with actual occupancy conditions.

END OF SECTION

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SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Relative humidity sensors.
2. Temperature sensors.
3. Momentary push button switch.
4. Windup timer switch.
5. Occupancy sensor.
6. Current sensors.
7. Pressure transmitters.
8. Pressure sensors.
9. Filter status monitoring transmitters.
10. Control air dampers.
11. Pressure independent control air dampers.
12. Control valves.
13. Electric damper actuators.
14. Variable frequency drives.
15. Transformers.
16. Air flow measuring devices.
17. Alarm indication stations.
18. Freeze stats.
19. Kitchen ventilation controller.
20. Flow Meter (GPM)

B. Related Sections:
1. Section 23 05 13 – Common Motor Requirements for HVAC Equipment: Product requirements for electric motors.
2. Section 23 09 23 – Direct-digital Control System for HVAC: Product requirements for DDC control equipment.
3. Section 23 09 93 – Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.
4. Section 23 21 16 – Hydronic Piping Specialties: Product requirements for thermometer sockets.
5. Section 23 33 00 – Air Duct Accessories: Product requirements for duct mounted thermometers.
6. Section 26 05 03 – Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
1. AMCA 500 – Laboratory Methods of Testing Louvers for Rating.

B. American Society of Mechanical Engineers:
1. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASTM International:
1. ASTM B32 – Standard Specification for Solder Metal.
2. ASTM B280 – Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
3. ASTM D1693 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

D. Federal Communications Commission:
1. FCC Part 15.

E. National Electrical Manufacturers Association:
   1. NEMA DC 3 – Residential Controls - Electrical Wall-Mounted Room Thermostats.

F. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

G. National Institute of Standards and Technology:
   1. NIST – Policy on Traceability.

H. Underwriters Laboratory, Inc.:
   1. UL-873 – Temperature Reading and Indicating Equipment.
   2. UL 60730-1, 60730-2-9, Automated Electrical Controls.

1.3 SYSTEM DESCRIPTION

A. The Temperature Controls Contractor (TCC) is responsible for items in this Section.

1.4 SUBMITTALS

A. Shop Drawings: Indicate operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Coordinate submittals with information requested in Section 23 09 93.

B. Product Data: Submit description and engineering data for each control system component. Include sizing as requested.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.

B. Operation and Maintenance Data: Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Control Air Damper Performance: Test in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept controls on site in original factory packaging Inspect for damage.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 RELATIVE HUMIDITY SENSORS

A. Manufacturers:
   1. Automatic Components, Inc. (ACI).
   2. Veris Industries.

3. MAMAC Systems, Inc.

B. Humidity Sensor:
1. Duct mounted, sampling chamber.
2. Throttling range: Adjustable, 2 percent, relative humidity.
3. Operating range: 10 to 95 percent.
4. Maximum temperature: 395 degrees F.

C. Room Humidistats:
1. Wall mounted, capacitance type.
2. Throttling range: Adjustable, 2 percent, relative humidity.
3. Operating range: 10 to 95 percent.
4. Maximum temperature: 395 degrees F.
5. Cover: Concealed setpoint.

D. Limit Duct Humidistat:
1. Insertion, capacitance type.
2. Throttling range: Adjustable 2 percent relative humidity.
3. Operating range: 10 to 95 percent.
4. Maximum temperature: 395 degrees F.

2.2 TEMPERATURE SENSORS

A. Manufacturers:
1. Automatic Components, Inc. (ACI).
2. Veris Industries.
3. MAMAC Systems, Inc.

B. Electronic Room Temperature Sensor:
1. Type: NEMA DC 3, 24 volts.
2. Performance: Minimum accuracy of 0.36 degrees F, minimum stability of 0.23 degrees F.
3. Service: cooling and heating.
4. Covers: Locking with concealed setpoint.
5. Features:
a. Temperature signal.
b. Humidity signal.
c. Temperature set point adjustment knob/wheel.
d. Occupancy override button.

C. Room Temperature Sensor Accessories:
1. Insulating Bases: For sensors located on exterior walls.
2. Thermostat Guards: Metal or locking transparent plastic mounted on separate base.

D. Immersion Well Sensor:
1. Stainless steel immersion well for fluid temperature sensors. Wells must be filled with heat transfer compound. Provide pipe fittings and adaptors as required to allow proper sensing of fluid temperature in main pipe..
2. Length: As required for proper fluid sensing.

E. Air-stream Sensor:
1. Provide appropriate length probe sensor for duct size with NEMA type 1 enclosure. Averaging Sensor:
a. Provide a 24-foot averaging sensor with sensing elements every 3 feet minimum. Sensor must provide 75% coil area coverage; provide longer lengths as required.

2.3 MOMENTARY PUSH BUTTON SWITCH

A. Manufacturers:

1. Kele
2. ACI
3. Mamac
4. IDEC

B. Push button:
1. Contact Rating 10A, 600 VAC/VDC; 5mA, 3 VAC/VDC minimum
2. Electrical Life 500,000 minimum operations
3. Approvals UL listed, File #E68961; CSA certified, File #LR48366
4. Stainless steel wall plate box.
5. Button size: 2.4 cm.
6. Use indicator: Provide switch label indicating usage and duration.
7. Plastic Flip Cover Guard: Transparent plastic cover mounted to base with internal visibility maintained.

2.4 WINDUP TIMER SWITCH

A. Manufacturers:
1. Intermatic
2. Kele
3. Mamac

B. Timer
1. Spring wound.
2. Length of time: Refer to sequence of operations for timer length.
3. Plate: stainless steel.

2.5 OCCUPANCY SENSOR

A. By Others. Refer to Section 26 27 26 – Wiring Devices.

2.6 CURRENT SENSORS

A. Manufacturers:
1. Automatic Components, Inc. (ACI).
2. Veris Industries.
3. MAMAC Systems, Inc.
4. Hawkeye Energy Solutions.

B. Analog current sensor shall be loop powered, fully isolated with a 4 to 20 ma or 2 to 10 volt DC output, sensor through-hole to accommodate up to #2/0 THHN insulated wire suitable for sensing up to 200 amperes, and provided with over-range protection. Sensor shall provide accuracy of plus or minus 0.5 percent of full scale, linearity and repeatability of plus or minus 0.1 percent of full scale, and response time of no less than 300 milliseconds to 99 percent of full scale.

C. Current status switches:

D. Provide an accurate current switch rated to sense the proper amperage of the load that is being monitored.

2.7 PRESSURE TRANSMITTERS

A. Manufacturers:
1. Automatic Components, Inc. (ACI).
2. Veris Industries.
3. MAMAC Systems, Inc.
4. Dwyer Instruments, Inc.
5. Siemens Industry, Inc.

B. Provide where required by the Sequence of Operation. Refer to Section 23 09 93.

C. Differential pressure transmitters shall be solid state suitable for the measured medium, range and pressures of the application, with adjustable span and zero, and accuracy of plus or minus one percent of the span.

D. Static pressure transmitters shall be solid-state piezoresistive silicon suitable for the measured medium, range and pressures of the application, with adjustable span and zero, and accuracy of plus or minus one percent of the span, linearity and hysteresis of plus or minus 0.1 percent of span, and repeatability of 0.25 percent of span.

E. Velocity pressure transmitters shall be solid state suitable for the measured medium, range and pressures of the application, with adjustable span and zero, and accuracy of plus or minus one percent of the span.

F. Analog Output Transducers shall be designed for precision closed loop control with pneumatic repeatability error no greater than one percent.

2.8 PRESSURE SENSORS FOR BUILDING STATIC PRESSURE

A. Outdoor pickup sensor shall be Dwyer A-306-A or approved equal, and shall connect to a building static pressure transmitter.

B. Indoor pickup sensor shall be Dwyer A418 or approved equal, and shall connect to a building static pressure transmitter.

2.9 FILTER STATUS MONITORING TRANSMITTER

A. Manufacturers:
   1. Automatic Components, Inc. (ACI).
   2. Veris Industries.
   3. MAMAC Systems, Inc.
   4. Dwyer Instruments, Inc.

B. Applies to all air handling units, and filter banks except terminal boxes.

C. Each system with filters shall have one differential pressure sensor across each filter bank. This sensor shall provide an analog output to the BAS to remind operator to change the filters. These include any equipment with filter banks.

D. Alarms shall be programmed to indicate when air pressure across filters exceeds the recommended dirty filter set point.

E. Clean filter losses shall be obtained from measurements at any equipment with filter banks.

2.10 CONTROL AIR DAMPERS

A. Refer to Section 23 33 00. Provided by Mechanical Contractor.

2.11 PRESSURE INDEPENDENT CONTROL AIR DAMPERS

A. Refer to Section 23 33 00. Provided by Mechanical Contractor.

2.12 CONTROL VALVES - BALL

A. Manufacturer:
   1. Belimo Aircontrols, Inc.
   2. Schneider Electric. Model: DuraDrive Series.

B. All proportional controlled valves shall be controlled via 0-10VDC or 4-20ma signal. No floating valve control will be accepted.

C. Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system unless otherwise indicated. Provide valves with configurations and

flow rates as indicated on drawings. Stem and ball shall be stainless steel. Close off pressure shall be 125 psi or greater per valve.

D. Sizing: 3 psig maximum pressure drop at design flow rate.

E. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

F. Modulating proportional control, 0-10VDC or 4-20ma.
   1. Applicable Equipment:
      a. VAV terminal units.
      b. Finned tube radiation.
      c. Radiant ceiling panels.
      d. Active chilled beams.
      e. Induction displacement units.

G. Open/Closed control signal.
   1. Applicable Equipment:
      a. Cabinet unit heaters.
      b. Unit heaters.

2.13 ELECTRIC DAMPER ACTUATORS

A. Manufacturers:
   1. Belimo Aircontrols, Inc.
   2. Schneider Electric. Model: DuraDrive Series.

B. Operation: Two-position or reversing type proportional motor, as determined by location and application.

C. Enclosure Rating: NEMA 250 Type 1 Enclosure.

D. Mounting: Direct mount.

E. Stroke: Maximum 150 seconds end to end full stroke, Maximum 20 seconds return to normal for spring return.

F. Protection: Electronic stall protection.

G. Control Input: 0-10 VDC or 0-20 mADC.

H. Power: Nominal 24 or 120 volt AC.

I. Torque: Size for minimum 150 percent of required duty.

J. Duty cycle: rated for 65,000 cycles.

K. Accessories:
   1. Cover mounted transformer.
   2. Auxiliary potentiometer.
   3. Damper linkage.
   4. Direct drive feedback potentiometer.
   5. Output position feedback.
   6. Field selectable rotational, spring return direction, field adjustable zero and span.
   7. End switch.

2.14 VARIABLE FREQUENCY DRIVES (VFD)

A. Manufacturers:
   1. Square D (Schneider Electric).
   2. Cutler-Hammer (Eaton).
   3. Allen-Bradley (Rockwell Automation, Inc.).

4. Danfoss Group Global.
5. ABB.
6. Yaskawa America, Inc.
7. All VFDs provided and installed by the Temperature Controls Contractor shall be the same manufacturer.

B. All roof mounted air handler units shall have the VFDs factory mounted in the units with provisions for low ambient conditions and venting as required to ensure proper operation.

C. Furnish complete variable speed drive(s) as specified herein. All standard and optional features requested shall be included within the VFD enclosure unless otherwise specified. Drives shall be for variable torque load, unless otherwise noted.

D. The variable speed drives shall convert three-phase, 60 HZ utility power to adjustable voltage and frequency, three-phase, AC power for step less motor speed control from 10% to 100% of the motor's 60 Hz speed. Input voltage shall be as specified in the schedule.

E. The VFD power input stage shall convert three-phase AC line power to a fixed DC bus voltage. This will be accomplished with a solid state three-phase full-wave diode rectifier with metal oxide varistor (MOV) three-phase protection. Displacement power factor shall not be less than 0.95 throughout the speed range. Input line inductors (3%) shall be included on the line side of the power input state.

F. The VFD output power shall vary frequency to the motor from 6 to 60 Hz with resultant motor speed varying at the motor nameplate rated speed, with output voltage variation from zero to motor rated voltage for optimum volts per hertz (V/Hz) ratio for fan and pump loads. Output current shall be rated 110% of motor full load amps (FLA) for 1 minute based upon VFD's variable torque FLA rating. The output must be a voltage source type generating a sine coded PWM waveform utilizing an asynchronous carrier frequency (output transistor switching frequency is to be independent of drive output frequency). This carrier frequency shall be adjustable to minimize harmonically induced noise or vibration.

G. The VFD shall include the following features:
1. The VFD shall be housed in a NEMA 1 enclosure.
2. The following display/control parameters shall be located on the front of the enclosure:
    a. Hand/Off/Auto selector to start and stop the motor. In the auto position, the drive shall start/stop from a remote contact closure. In the auto position, motor speed shall be determined by the follower signal. In the manual position, motor speed shall be determined by a manual adjustment.
    b. Power on indication that the VFD is being supplied by the power line.
    c. Fault indication that the VFD has tripped on a fault condition.
    d. Display shall indicate load parameters such as load percent, frequency or running load amps.
3. A set of form C, dry contacts to indicate when the VFD is in the run mode.
4. A set of form C, dry contacts to indicate when the VFD is in the fault mode.
5. Terminations for safety interlocks such as freeze and smoke shut-down.
6. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function shall provide up to 6 programmable restart attempts. The time delay before restart attempts shall be a minimum of 30 seconds. This function permits automatic restarting after the drive controller detects a fault, provided that the other operating functions are correct, a run command is present, and the fault has disappeared. This shall be a function that is field selectable.
7. Speed Reference Input: Shall accept both a manual speed signal and a 0-10 VDC speed reference analog input signal from the Building Automation System (BAS).
8. Feedback Signal: Provide 0-5 VDC or 0-20 mA analog output signal to indicate actual operating speed of VFD. Output signal shall be fed into the BAS.
9. Skip Frequencies: Lock-out resonant frequencies of fans or pumps.

H. The VFD shall include the following protective features:
   1. Protection against input transient voltage spikes.
   2. Separate overload protection for each motor controlled.
   3. Protection against input power under voltage, over voltage, and phase loss.
   4. Protection against output current overload and over current.
   5. Protection against over temperature within the VFD enclosure.
   6. Protection against over voltage on the DC bus.
   7. DC bus discharge circuit for protection of service personnel.
   8. Insensitive to incoming power phase sequence.

I. The VFD shall include the following adjustments inside the enclosure:
   1. Maximum speed, adjustable 50-100% base speed.
   2. Minimum speed, adjustable 0-50% base speed.
   3. Acceleration time, adjustable 3 to 1800 seconds.
   4. Deceleration time, adjustable 3 to 1800 seconds with override circuit to prevent nuisance trips if decel time is set too short.
   5. Current limit, adjustable 0-100%.

J. The VFD shall be designed to operate within the following service conditions:
   1. Ambient temperature, 0-40 degree C (32 to 104 degree F).
   2. 0 to 95% relative humidity, non-condensing.
   3. Elevation to 1,000 meters (3,300 feet) without derating.
   4. AC line voltage variation, -10% to +10% of nominal.

K. The VFD shall be provided with an complete, wired internal factory mounted disconnect switch.

2.15 TRANSFORMERS

A. Manufacturers:
   1. Square D (Schneider Electric).
   2. Veris Industries.
   3. MAMAC Systems, Inc.
   4. Honeywell International, Inc.

B. Provide adequate low voltage transformer power to all DDC controllers. Transformers shall not be loaded greater than 75% of rated VA capacity.

C. Transformer locations and equipment served by transformer must be noted and documented on drawings and final as-builts.

D. Transformers shall be equipped with circuit protection for the low voltage circuit.

2.16 AIRFLOW MEASURING DEVICE

A. Manufacturers:
   1. Ebtron, Inc.
   2. Approved equal that meets the specification requirements will be considered if applicable.

B. Provide a copy of each of the following Independent Test Reports:
   1. NIST Report of Airflow Calibration.
   2. CHEMIR Test Report on Sensor Exposure to Salts and Acids.
   3. UL Certificate Report.
   4. CE Certification form (European shipments).
   5. FCC Part 15 Compliance Report.
   6. BTL Certification Report.

C. General Requirements, Construction, and Features:
   1. Provide one thermal airflow measuring device (AMD) for each location indicated on plans, schedules, and/or control diagrams, or as recommended by the authorized representative's

certified installed for a complete and functional air flow measurement system. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices.

2. Each AMD shall use the principal of thermal dispersion to determine the actual or mass airflow rate of the airstream. Differential pressure-based devices including pitot tubes, pitot arrays, piezo-rings and devices measuring the pressure drop across a louver, damper or obstruction are not acceptable.
3. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. The airflow of each sensor node shall be determined using one self-heated and ambient temperature sensing thermistor. Devices using indirectly heated thermistors to determine the airflow rate are not acceptable. Devices using chip thermistors of any type or packaging are not acceptable. Devices using platinum wire RTDs or similar "hot wire" devices are not acceptable.
4. Thermistors shall be potted in an engineering thermoplastic assembly using water-proof, marine epoxy and shall not be damaged by moisture, direct contact with water or exposure to atmospheric acids. Provide a copy of an independent laboratory report to verify compliance with this requirement.
5. All internal wiring in the probe tube shall be chemical and abrasion resistant Kynar® coated copper.
6. All connections to internal wires in the probe tube shall be solder joints or welds. Connectors of any type in the probe tube are not acceptable.
7. The airflow sensing thermistor of each sensor node shall be self-heated. Devices using indirectly heated thermistors are not acceptable.
8. The specified sensor accuracy shall include the combined uncertainty of the sensor nodes and transmitter. Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with the specified sensor accuracy over the entire operating range.
9. Installed accuracy shall include the uncertainty of the AMD and the additional uncertainty that results from the placement of the AMD in the airstream. The specified installed accuracy is based on the AMD being installed in accordance with manufacturers published placement and installation guidelines.
10. TCC shall provide all AMDs and is responsible for all calibration, adjusting, programming, and tuning necessary for accurate and stable readings.

D. Project Airflow Measuring Applications and Device Types:
   1. Duct and plenum AMD with temperature measurement and remote transmitter.
      a. Basis of Design: EBTRON Models GTx116-P+ and GTx116e-PC.
      b. Each AMD shall be suitable for installation in ducts and plenums including air handling equipment cabinets and outdoor air intakes to determine the airflow rate and velocity weighted temperature of the airstream.
      c. Each sensor node shall be individually wind-tunnel calibrated at 16 points to NIST traceable airflow standards and have an accuracy of ±2% of reading over the entire operating range. Provide a copy of the NIST calibration report for the reference standard used to calibrate the production tunnels used to calibrate individual sensor nodes. Reference standards calibrated to third-party NIST traceable labs are not acceptable. Devices claiming AMCA certification are not acceptable.
      d. Provide up to 16 sensing nodes per measurement location as required for the opening size and published sensor density tables to achieve an installed airflow accuracy of ±3% (±5% of reading on close coupled outdoor air intakes) between 0 and 5,000 fpm over a temperature range of -20 to 160°F and a humidity range between 0 and 100% RH (non-condensing).
      e. Provide the velocity weighted temperature of the airstream with an accuracy of ±0.15°F.
      f. Provide low and high airflow alarms with a user defined setpoint and tolerance.
      g. The airflow rate, temperature, airflow alarm and system status alarm shall be visible on the transmitters display.

h. Transmitters with network capability shall provide the airflow, velocity weighted temperature, airflow alarm status, individual sensor node airflow and temperature data and device fault status.
i. Provide a Bluetooth, low-energy interface and free Android® or iOS® software that allows real-time airflow and temperature monitoring and airflow and temperature traverses. Software shall capture, save and/or e-mail airflow/temperature data, transmitter settings and diagnostics information.
j. Each AMD shall be powered by 24 VAC (22.8 to 26.4 VAC under load) and have a maximum power requirement of 22 V-A.

2. Duct and plenum AMD with temperature and humidity measurement and remote transmitter.
   a. Basis of Design: EBTRON model GTx116e-PC/H.
   b. Each AMD shall be suitable for installation in ducts and plenums including air handling equipment cabinets and outdoor air intakes to determine the airflow rate, velocity weighted temperature and humidity of the airstream. Enthalpy and dewpoint shall be calculated using the velocity weighted temperature, humidity and on-board pressure sensor.
   c. Each sensor node shall be individually wind-tunnel calibrated at 16 points to NIST traceable airflow standards and have an accuracy of ±2% of reading over the entire operating range. Provide a copy of the NIST calibration report for the reference standard used to calibrate the production tunnels used to calibrate individual sensor nodes. Reference standards calibrated to third-party NIST traceable labs are not acceptable. Devices claiming AMCA certification are not acceptable.
   d. Provide up to 16 sensing nodes per measurement location as required for the opening size and published sensor density tables to achieve an installed airflow accuracy of ±3% of reading (±5% of reading on close coupled outdoor air intakes) between 0 and 5,000 fpm over a temperature range of -20 to 160°F and a humidity range between 0 and 100% RH (non-condensing).
   e. Provide the velocity weighted temperature of the airstream with an accuracy of ±0.15°F.
   f. Provide humidity measurement of the airstream with the following accuracy at 77°F:
      1) ±2% of reading between 20 and 80% RH.
      2) Better than ±4% of reading at all other % RH at 77°F.
   g. Provide low and high airflow alarms with a user defined setpoint and tolerance.
   h. The airflow rate, temperature, humidity, enthalpy or dewpoint, airflow alarm and system status alarm shall be visible on the transmitters display.
   i. Transmitters with network capability shall provide the airflow, velocity weighted temperature, humidity, enthalpy, dewpoint, airflow alarm status, individual sensor node airflow and temperature data and device fault status.
   j. Provide a Bluetooth, low-energy interface and free Android® or iOS® software that allows real-time airflow, temperature and humidity monitoring and airflow and temperature traverses. Software shall capture, save and/or e-mail airflow/temperature/humidity data, transmitter settings and diagnostics information.
   k. Each AMD shall be powered by 24 VAC (22.8 to 26.4 VAC under load) and have a maximum power requirement of 22 V-A.

3. Small duct and terminal box AMD with temperature measurement and remote transmitter.
   a. Basis of Design: EBTRON model EF-x2000-T.
   b. Each AMD shall be suitable for installation in round duct, 4 to 16 inches in diameter, to determine the airflow rate and velocity weighted temperature of the airstream.
   c. Each probe shall be individually wind-tunnel calibrated at 7 points to NIST traceable volumetric airflow standards. Devices claiming AMCA certification are not acceptable.
   d. Provide the velocity weighted temperature of the airstream with an accuracy of ±0.15°F.
   e. Provide low and high airflow alarms with a user defined setpoint and tolerance.
   f. The airflow rate and temperature, airflow alarm and system status alarm shall be visible on the transmitters display.

g. Provide a contact closure relay that can be assigned to the airflow alarm or system status alarm. The relay shall be capable of passing 3 Amps at 24 VAC or 30 VDC or be configured to drive an LED.
h. Transmitters with network capability shall provide the airflow, velocity weighted temperature, humidity, enthalpy, dewpoint, airflow alarm status, individual sensor node airflow and temperature data and device fault status.
i. Each AMD shall be powered by 24 VAC (22.8 to 26.4 VAC under load) and have a maximum power requirement of 8 V-A.

4. Small duct and terminal box AMD with temperature measurement and integral transmitter.
a. Basis of Design: EBTRON model EF-x1000-T.
b. Each AMD shall be suitable for installation in round duct, 4 to 16 inches in diameter, to determine the airflow rate and velocity weighted temperature of the airstream.
c. Each probe shall be individually wind-tunnel calibrated at 7 points to NIST traceable volumetric airflow standards. Devices claiming AMCA certification are not acceptable.
d. EF-A1001-T and EF-N1000-T: Provide the velocity weighted temperature of the airstream with an accuracy of ±0.15°F.
e. Transmitters with network capability shall provide the airflow, velocity weighted temperature, individual sensor node airflow and temperature data and device fault status.
f. Each AMD shall be powered by 24 VAC (22.8 to 26.4 VAC under load) and have a maximum power requirement of 5 V-A.

5. Fan airflow AMBD with temperature measurement and remote transmitter.
a. Basis of Design: EBTRON models GTx108-F.
b. Each AMD shall be suitable for installation in fan inlets to determine the airflow rate and velocity weighted temperature of the airstream.
c. Provide throat, face, forward or flare mount adjustable brackets for each sensor node.
d. Face, forward and flare mount styles shall not affect the airflow or sound performance of plenum fans.
e. Each sensor node shall be individually wind-tunnel calibrated at 16 points to NIST traceable airflow standards and have an accuracy of ±2% of reading over the entire operating range of 0 and 10,000 fpm [50.8 m/s] over a temperature range of -20 to 160°F and a humidity range between 0 and 100% RH (non-condensing).
f. Provide the velocity weighted temperature of the airstream with an accuracy of ±0.15°F.
g. Provide low and high airflow alarms with a user defined setpoint and tolerance.
h. Provide a fan fault alarm when installed on fan arrays.
i. The airflow rate, temperature, airflow alarm, fan fault alarm and system status alarm shall be visible on the transmitters display.
j. Transmitters with network capability shall provide the airflow, velocity weighted temperature, airflow alarm status, fan array fault alarm (/An models), individual sensor node airflow and temperature data and device fault status.
k. Provide a Bluetooth, low-energy interface and free Android® or iOS® software that allows real-time airflow and temperature monitoring, individual fan airflow, and airflow and temperature traverses. Software shall capture, save and/or e-mail airflow/temperature data, transmitter settings and diagnostics information.
l. Each AMD shall be powered by 24 VAC (22.8 to 26.4 VAC under load) and have a maximum power requirement of 16 V-A.

6. Probe AMD/damper assembly for outdoor air intakes, return air intakes and exhaust air intakes.
a. Basis of Design:
1) Outdoor Air Intakes: EBTRON Model AIR-IQ2.
2) Non-ducted Return Air and Exhaust Air Intakes: EBTRON Model AIR-IQ.
b. Provide one GTx116-P+ or GTx116e-PC AMD in a factory assembled control damper assembly.

7. Fan inlet AMD/backdraft damper assembly.
a. Basis of Design: EBTRON Model FAN-IQ.

b. Provide one GTx116-F AMD mounted in a factory assembled backdraft sensor assembly.

2.17 ALARM INDICATION STATION

A. Manufacturers:
1. Kele. Model: AIS.

B. Provide alarm indication station with indication light, alarm horn, alarm horn silence switch, polystyrene case, and LED light.

2.18 FREEZE STAT

A. Manufacturers:
1. Automatic Components, Inc. (ACI).
2. MAMAC Systems, Inc.
3. Johnson Controls, Inc.
4. Schneider Electric.
5. Honeywell International, Inc.

B. Freeze protection thermostat: Automatic reset and dual contacts. One set of contacts shall be hardwired to stop fan in the event of a trip. The second set of contacts shall be used to send a signal to the BAS.

C. Trip range shall be adjustable and set for 35 degree F initially.

D. Sensor probe shall be averaging, and shall adequately cover the entire face of the coil.

2.19 KITCHEN VENTILATION HEAT SENSOR

A. Provide heat sensor per IMC 507.2.1.1.

2.20 KITCHEN VENTILATION CONTROLLER – VARIABLE VOLUME SYSTEM

A. Manufacturers:
1. Accurex, Model: XKC-DCV-S.
2. CaptiveAire Systems, Model: EMS Plus.

B. Features:
1. Touch Screen interface for controls, setup and diagnostics
2. Touch Screen display of real time fan speeds, CFM monitoring and VFD diagnostics
3. Adjustment of fan speed settings and fan direction change available from touch screen
4. Room temperature sensor included to start the fans based on temperature offset differential between room and duct
5. Preparation time feature: Run exhaust fans at low CFM and no make-up air in the morning
6. Programmable schedule
7. Building management remote control
8. Demand ventilation system is designed to automatically reduce exhaust and supply airflow quantities, while ensuring hood performance is maintained

C. The system includes a touch screen interface for fan(s) and hood lights control, wash control (if applicable), gas valve reset, programmable schedule, 100% Airflow Override function, preparation time mode and diagnostics including VFD status. All touch screen pages displayed show descriptive icons or plain text explaining the functions or values. The touch screen interface will be NEMA 4 rated in order to withhold grease and water when installed on the face of the hood or utility cabinet.

D. Control enclosure will be NEMA 1 rated and listed for installation inside of the exhaust hood utility cabinet. Control enclosure may be constructed of stainless steel or painted steel.

E. The programmable logic controller (PLC) will constantly monitor the exhaust air temperature through the riser mounted temperature sensor and modulate the fan speeds accordingly.

F. A room temperature sensor will also be provided for field installation in the kitchen space in order to start the fan(s) based on the temperature differential between the room and the exhaust air in the duct, rather than fixed set-points.

G. A Preparation Time Mode is available for morning operation: dedicated make-up air will be locked out only allowing the use of transfer air during this mode. Exhaust fan(s) will run at low CFM while maintaining a balanced kitchen pressure.

H. Acceleration and deceleration times are adjustable. Fan maximum/minimum speeds will be adjustable for proper kitchen balance. Fan direction change is also available from the touch screen interface without need for rewiring.

I. Resistive Temperature Detector (RTD) will be mounted in the exhaust hood riser(s). Temperature probes will be constructed of Stainless Steel. System will be factory pre-set to modulate fan speed within a range of 45 degree F for 600 degree F and 700 degree F cooking applications and a range of 5 degree F for 400 degree F cooking applications. Set-points are fully adjustable through the touch screen interface based on application needs.

J. The 100% Airflow Override will have an adjustable timeout value.

K. The panels include color coded wiring with as-built wiring diagrams, and spare terminals controlled by the fire system micro switch. The panel is factory pre-wired to shut down supply fans in a fire condition. Options to turn on the exhaust fans or turn off the hood lights in a fire condition will be configurable through the touch screen but only through a password protected menu to prevent any changes after a fire inspection has been performed.

2.21 FLOW METERS (GPM)

A. Manufacturers:
   1. Onicon
   2. Prior Approval.

B. The flow meter shall have two contra-rotating axial turbines, with electronic impedance-based sensing and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion. Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to NIST*.

C. A certificate of calibration shall be provided with each flow meter. Accuracy shall be within ± 0.5% of rate at the calibrated velocity, within ± 1% of rate over a 10:1 turndown (3.0 to 30 ft/s) and within ± 2% of rate over a 50:1 turndown (from 0.4 to 20 ft/s). Output signal shall be a 0-15 V square wave pulse.

2.22 EXECUTION

2.23 EXAMINATION

A. Verify building systems to be controlled are ready to operate.

B. Verify that conditioned power supply is available to control units.

C. Verify air handling units and ductwork have been accepted and air filters are in place before installing sensors in air streams.

D. Verify location of thermostats and other exposed control sensors with Drawings before installation.

2.24 INSTALLATION

A. Install equipment level and plumb.

B. Install thermostats, humidistats, space temperature sensors, and other exposed control sensors after locations are coordinated with other Work.

C. Install thermostats, humidistats, space temperature sensors, and other exposed control sensors 60 inches (or 48 inches above floor when required for ADA compliance). Align with light switches.

D. Install freeze protection thermostats using flanges and element holders.

E. Install carbon monoxide (CO) alarms in all new and existing rooms containing a fuel-burning appliance per 2020 Minnesota Mechanical and Fuel Gas Code. CO alarms shall be UL 2034 listed.

F. Provide separable sockets for liquids and flanges for air bulb elements.

G. Install thermostats as indicated on Drawings.

H. Install guards on thermostats in public areas, entrances, gymnasiums, and as indicated on Drawings.

I. Install control panels adjacent to associated equipment on vibration free walls or freestanding supports. Use one cabinet for each system. Install engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

J. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

K. Install conduit and electrical wiring in accordance with Section 26 05 03.

L. Control wiring shall be installed in EMT conduit in inaccessible locations shuch as walls and floors and where exposed on walls.

M. Install labels and nameplates to identify control components. Refer to Section 23 05 53. Label as indicated on Drawings and coordinate all labels with the Mechanical Contractor, Plumbing Contractor, and Electrical Contractor.

2.25 INSTALLATION – KITCHEN VENTILATION

A. Install heat sensor ventilation controller per IMC 507.2.1.1 .

2.26 FIELD QUALITY CONTROL

A. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

2.27 DEMONSTRATION AND TRAINING

A. Demonstrate complete operation of systems, including Sequence of Operation prior to Date of Substantial Completion.

B. Demonstrate complete and operating system to Owner. Refer to Section 23 09 93.

END OF SECTION

SECTION 23 09 23 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section includes control equipment and software.

B. Related Sections:
   1. Section 23 09 00 - Instrumentation and Control for HVAC: Control system components.
   2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 135 – BACnet: A Data Communication Protocol for Building Automation and Control Networks.

1.3 SYSTEM DESCRIPTION

A. The Temperature Controls Contractor (TCC) is responsible for items in this Section.

B. Building Management System (BMS): Distributed process control system consisting of centralized server, central TCP/IP communications, and remote control systems to control and monitor the following building systems:
   1. Heating, ventilating, and air conditioning systems.
   2. Energy management and monitoring.
   3. Power and electric management.

C. Central Control System: Configure central processing units, mass memory units, data terminal units, and related software to perform the following functions:
   1. Provide automatic control of building systems.
   2. Develop, store, access, and update building management database.
   3. Provide operator interface with system.
   4. Provide secured, web based interface for access via the intranet and internet.
   5. Display and record system operation.

D. Central Communication System: Configure central communication units, data communication network, and related software to control input and output between central control system and remote control systems.

E. Remote Control System: Configure remote control units, input sensing devices, and output control elements to perform the following functions:
   1. Process variable sensing, signal transmitting, and signal conversion for each input point.
   2. Signal conversion, transmitting, and operation of control drive or other element for each output point.
   3. Receive remote control programs and system data from central communication system.
   4. Manual entry of remote control programs.
   5. Storage of data and remote control programs.
      1) Execute remote control program commands.
      2) Transmit local status data to central communication system.
      3) Execute commands received from central communication system.

F. Every point on the system shall have the ability to be trend logged.

G. Every Damper, Valve, and Variable Frequency Drive (VFD) shall have a separate output point, controllable individually from the BAS.

H. The BMS shall control the direct-digital controls system for HVAC. The BAS shall also integrate with the fire alarm system to monitor smoke management functions, such as smoke damper position. The BMS shall be controlled through a single graphical, web-based operator interface that allows for instant access to any sub-system through a standard browser. Systems requiring two or more different PC workstations are not acceptable.

I. The BMS workstation and HVAC controllers shall be designed to provide PC-based programming and microcomputer controllers of modular design providing distributed processing capability. Contractor must provide manufacturer's Protocol Implementation Conformance Statement (PICS) for workstation software and every controller model that are installed.

J. Automatic temperature controls field monitoring and control system using field programmable microprocessor based controllers. System shall be capable of communicating with other building systems installed with ASHRAE 135 compatible devices.

K. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

L. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

M. Provide graphics package for existing PC Workstation that includes display of all essential points. Graphics are to be designed and modified to Owners preference. Owner shall determine final acceptance of complete graphic package.

N. Provide controls for new air handling units, packaged makeup air units, variable air volume terminals, radiation, reheat coils, induction units, air control valves, chilled beams, unit heaters, intake and relief hoods, destrat fans, kitchen exhaust, kiln exhaust, and general exhaust fans when directly connected to control units.

O. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified.

P. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

Q. All core components (database, programming files, graphics, software, licenses, and software/hardware tools) necessary to make programming adjustments at all levels shall be included. The Owner and Architect/Engineer shall be able to review and modify every aspect of the system without exception. Any piece of controls equipment (i.e. sensors, controllers, workstation, software, license, or software/hardware tool, etc.) found not to be provided shall be the responsibility of the Temperature Control Contractor to provide at their expense. The Architect/Engineer shall determine if the contractor has not provided all necessary components.

1.4 PERFORMANCE REQUIREMENTS

A. Provide system which can be fully accessible via the internet. The Owner will provide for one connection to its own LAN per building and will assign a static IP address for the automation system. Under no circumstances shall the facility's LAN be utilized for communication among system controllers. The owner shall provide fiber network space for multiple building connections and communication back to the central server.

B. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic display. A graphic with 25 dynamic points shall display with current data with 5 sec.

2. Graphic Refresh. A graphic with 25 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 10 sec.
3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 5sec.
4. Object Command. Devices shall react to command of a binary object within 5 sec. Devices shall begin reacting to command of an analog object within 5 sec.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Execution times shall be consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Execution times shall be consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the networks shall receive alarms with 20 sec of other workstations.
9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy
10. Control Stability and Accuracy. Control loops shall maintain measured variable at plus or minus 5 percent of set point. Control loop stability shall be achieved 15 minutes or less after startup to avoid energy waste, excessive noise, equipment damage, or comfort issues.

1.5 SUBMITTALS

A. Shop Drawings: Indicate the following:
1. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
2. Connected data points, including connected control unit and input device.
3. System graphics showing monitored systems, data (connected and calculated) point addresses, and operator notations.
4. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
5. Description and sequence of operation for operating, user, and application software.
6. Coordinate submittals with information requested in Section 23 09 93.

B. Provide a detailed Valve Schedule for all control valves including: Zone/equipment served, Tag ID, fluid type, valve part #, actuator part#, voltage, spring range, torque, valve type, valve size, pipe size, valve action, connection type, GPM, CV, pressure drop, close off PSI.

C. Provide a detailed Variable Frequency Drive schedule.

D. Front-End Graphical User Interface Submittal.
1. Provide a hard copy color graphic for each primary device (air handling unit, heating plant, cooling plant, energy data, etc.).
2. Provide floorplan overview graphics layout and proposed building subdivisions; indicate equipment and status locations being displayed.
3. Provide a typical graphic for each air handling unit zone summary page.
4. Provide a typical graphic for each terminal device.
5. Provide graphics that show all hyperlinks to other pages identified.
6. Submit within 60 days of the award of the general contract.
7. Provide samples of energy monitoring spreadsheets to be used.

E. Programming Submittal
1. Indicate system graphics of monitored systems, data (collected and calculated), point addresses, and operator notations.
2. Provide control program logic diagrams for all major systems.
3. Include programmer comments and notation.

4. The completed submittal must be submitted within 45 days after final engineer approval of the other controls submittals.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Submit data specified in "Submittals" in final "Record Documents" form.

B. Operation and Maintenance Data:
   1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

C. Operation Verification Report:
   1. Submit report indicating results from operational testing showing that all control sequences are functioning properly.

1.7 PAYMENT & SCHEDULE OF VALUES

A. Controls contractor shall submit a schedule of values which itemizes each of the mentioned submittals as well as all materials and labor required for the project.

B. Labor shall be subdivided as “field installation” and “programming”. No payment for labor or materials will be made until payment has been applied for and paid for each of the submittals. Payment for the submittals will be made after they are approved by the Engineer.

1.8 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum five years documented experience approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect electronic components from construction operations, dust, and adverse environmental conditions.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 COORDINATION

A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.

B. Temperature Control Contractor (TCC) is required to coordinate with HVAC, Plumbing, and Electrical contractors and equipment suppliers so that all equipment supplied controls can be integrated into the Building Automation System. TCC is to coordinate with HVAC, Plumbing, and Electrical contractors and equipment suppliers for all field mounted controls components. TCC will be required to install these components or coordinate with HVAC, Plumbing, and Electrical contractors for these installations. TCC

will be responsible for all rough-ins to support any and all control components that are not shown on the electrical plans.

C. TCC shall provide and install conditioned electrical circuits for control units and operator workstation. TCC shall hire a licensed electrician as needed to provide and install all power circuits required for DDC hardware.

D. TCC shall coordinate all dampers and valve locations with HVAC and Plumbing contractors.

E. Provide documentation of successful point-to-point verification and sequence of operation verification. This shall be provided to the mechanical engineer, Testing & Balancing (TAB) Contractor, and the owners Commissioning agent. This shall be the point at which the TAB contractors work may commence.

F. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows:
   1. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation regardless of where within the contract documents those products are described.
   2. TCC shall coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
   3. TCC shall be responsible for the integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

G. Test and Balance:
   1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
   2. Train Test and Balance Contractor to use control system interface tools.
   3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
   4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

H. TCC shall coordinate all installation work with other trades to prevent space interference with other systems and materials. If installation without coordination causes interference with work of other trades, TCC shall correct conditions without extra charge.

I. Contractor shall arrange for work inspection by local or state Authorities Having Jurisdiction.

1.13 WARRANTY

A. Furnish five year manufacturer warranty for all furnished components and two year complete labor for all installed components

PART 2 PRODUCTS

2.1 SAFETY CONTROLS FOR ALL UNITS

A. Coordinate factory installed smoke detectors in packaged equipment with the equipment manufacturer.

B. Close outside air dampers and exhaust air dampers when unit fan is not in operation. Unless otherwise noted.

C. Interlock smoke detectors to air handlers for shutdown as specified in Section 23 09 93 – Sequence of Operations for Direct Digital Control.

D. Provide sensor on discharge of heating coil to de-energize unit fan when temperature falls below 32 degrees F and close outside air dampers. If a freezestat is utilized, Temperature control contractor shall provide a control strategy to minimize nuisance trips.

2.2 DIRECT DIGITAL CONTROLS

A. Manufacturers:
   1. Schneider Electric by St. Cloud Refrigeration.
   2. Schneider Electric by Uhl Company.
   3. Substitutions: Not Permitted.

2.3 SOFTWARE

A. Central Processing Unit Operating System: Memory-resident, real-time, multi-user, multi-tasking operating system to support ten simultaneous real-time processes and two batch processes.

B. Furnish the following operating system utilities:
   1. File create, copy, rename, move, delete
   2. Furnish high-level programming language compiler, with subroutines and remote control unit program instruction set to perform specified sequence of operation.

C. Operator Interface Software:
   1. Use English language displays, commands, and responses.

D. Remote Control Software: Furnish the following functions:
   1. Update input and output values at intervals of one second.
   2. Input and output conversion, scaling, offset, and nonlinear input correction.
   3. Error checking of input.

2.4 SYSTEM TOOLS

A. Provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone softer 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. Controller Memory Download: Operators shall be able to download memory from the system database to each controller.
   3. System Configuration: Operators shall be able to configure the system.
   4. Online Help: Context-sensitive online help for each tool shall assist operators in operating and editing the system.
   5. Security: System shall require a user name and password to view, edit, add, or delete data.
      a. Operator Access: Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.
      b. Automatic Log Out: Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic lock out delay.
      c. Encrypted Security Data: Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
   6. 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 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 09 93 – Sequence of Operations for HVAC Controls. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

7. System Diagnostics: System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).
8. Alarm Messages: Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.
9. Alarm Reactions: Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send email, send page, and audibly annunciate.
10. Alarm Maintenance: Operators shall be able to view system alarms and changes of state chronologically, to acknowledge an delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.
11. Object and Property Status and Control: Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.
12. Trend Configuration: 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 25 00 11 – Sequence of Operations for Direct Digital Controls. Trends shall be BACnet trend objects.

2.5 CONTROL UNITS

A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

B. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

C. Control Units Functions:
1. Monitor or control each input/output point.
2. Completely independent with hardware clock/calendar and software to maintain control independently.
3. Acquire, process, and transfer information to operator station or other control units on network.
4. Accept, process, and execute commands from other control unit's or devices or operator stations.
5. Access both data base and control functions simultaneously.
6. Record, evaluate, and report changes of state or value occurring among associated points. Continue to perform associated control functions regardless of status of network.
7. Perform in stand-alone mode:
    a. Start/stop.
    b. Duty cycling.
    c. Automatic Temperature Control.
    d. Demand control via a sliding window, predictive algorithm.
    e. Event initiated control.
    f. Calculated point.
    g. Scanning and alarm processing.
    h. Full direct digital control.
    i. Trend logging.
    j. Global communications.
    k. Maintenance scheduling.

D. Global Communications:
1. Broadcast point data onto network, making information available to other system controls units.
2. Transmit input/output points onto network for use by other control units and use data from other control units.

E. Input/output Capability:

1. Discrete/digital input (contact status).
2. Discrete/digital output.
3. Analog input.
4. Analog output.
5. Pulse input (5 pulses/second).
6. Pulse output (0-655 seconds in duration with 0.01-second resolution).

F. Provide a minimum of 10% space point capacity for each point type: AO, DO, UI.

G. Monitor, control, or address data points. Include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs. Furnish control units with percent spare capacity.

H. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

I. Upload/Download Capability: Download from or upload to operator station.

J. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from workstation.
2. Control output points but change only database state or value; leave external field hardware unchanged.
3. Enable control-actions on output points but change only data base state or value.

K. Local display and adjustment panel: [Portable] [or] [Integral to] control-unit containing digital display, and numerical keyboard. Display and adjust:
1. Input/output point information and status.
2. Controller set points.
3. Controller tuning constants.
4. Program execution times.
5. High and low limit values.
6. Limit differential.
7. Set/display date and time.
8. Control outputs connected to the network.
9. Automatic control outputs.
10. Perform control unit diagnostic testing.

L. Points in "Test" mode.

2.6 GRAPHICAL USER INTERFACE

A. The control system graphics shall consist of a series of graphic displays which are interlinked for the purposes of navigation and reporting.

B. Graphics shall be navigable by use of the building floorplan overviews. Every system servicing an area shall be accessible graphically. All HVAC equipment locations and current status shall be positioned on graphics in the actual locations of the equipment.

C. Indicate zone layout by color shading floorplan overviews.

D. Provide individual links to trend logs/graphs directly from the point location on the graphic.

E. Provide a link to the as-built drawings and O&M manuals directly from the graphics.

F. Provide a link to the as-built sequence of operations directly from the graphics.

G. All set points shall be located next to the process variable being controlled.

H. All equipment graphics shall be customized to display actual unit configuration; control devices and data shall be displayed in actual locations relative to the piece of equipment displayed on the graphics.

I. All adjustable set points shall have a clickable or graphical slider to adjust the value.

J. Every graphical point displayed shall have a timed override feature. All overrides shall be password protected.

K. All set point resets (discharge air reset, etc.) shall have a link to the reset adjustments; and indicate the values used to determine the reset.

L. The graphic user interface shall be made available via the internet in the same form, appearance and functionality with which it can be accessed from the operator workstation. All set points, schedules, trending, alarms and graphic screens shall be made accessible through this interface.

M. A security firewall shall be provided to password protect access to the control system via the operator workstation, mobile workstation and all access via the internet.

N. Provide a separate zone summary for each Air Handler indicating the following as applies:
   1. Space temp
   2. Space set point
   3. Supply temp
   4. Heating valve/stage
   5. CFM
   6. CFM set point
   7. Damper position
   8. Link to equipment details

O. Graphics shall display all equipment modes, for example, “economizer mode”.

P. Whenever an alarm is generated within the system, the graphic system shall show the alarm on the main system page as well as the page associated with the alarmed equipment.

Q. Provide floorplan overview graphics for all areas indicating zone temperatures. Provide red blinking text for zone temperatures that are 5 degrees F above set point; and blue blinking text for zone temperatures that are 5 degrees F below set point.

R. Each graphic shall be updated every 15 seconds or less.

S. Animated graphics for motor driven equipment shall show rotation when the unit is active and shall be motionless when the equipment is off.

T. Animated graphics for dampers and valves shall show relative positions of dampers graphically and percent open text display. 0% shall represent no flow, damper closed, no speed etc. 100% shall represent full flow, damper open, full speed etc.

U. Graphics shall indicate when multiple actuators are controlled from a common signal.

V. Update final graphics with owner requested revisions including room names, numbers, and equipment identifications.

W. All graphics are subject to final approval by Owner and Engineer.

X. Graphic editing tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files.

Y. Graphics library of standard HVAC equipment graphics shall include all HVAC equipment such as chillers, boilers, air handlers, terminals, fan coils, unit ventilators, etc. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file shall be compatible with graphics generation tools.

2.7 TRENDING

A. Each control unit will store samples of control unit's data points. Upload to server/storage location shall occur when controller memory reaches 80% full.

B. Update file continuously at discretely assignable intervals.

C. Automatically initiate upload request and then store data on hard disk. All trend data collected shall be permanently stored and backed up via central server that includes backup measures.

D. Archive data shall be accessible for trending to compare year to year data.

E. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.

F. Coordinate sampling with on/off state of specified point.

G. Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs. data.

H. Sample up to 30 points, real or computed, with each point capable of colleting 60 samples at intervals specified in minutes, hours, days, or month.

I. Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique color, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

J. Trending shall be implemented in a manner that does not affect system performance, communication, graphical update times, etc.

K. Coordinate the recording interval and storage duration with the Owner and engineer before Substantial Completion.

2.8 ALARMS

A. Each control unit will store samples of control unit's data points. Upload to server/storage location shall occur when controller memory reaches 80% full.

B. All process variables and inputs shall alarm when the value is out of operating range, indicating a failed sensor.

C. Coordinate all alarm delays with Owner/Engineer to provide accurate and reliable alarming.

D. All alarms shall trigger an audible alarm sound on the operator workstation when the alarm is active.

E. Allow definition of minimum of 20 messages, each having minimum length of 60 characters for each individual message.

F. All alarms shall have an acknowledgement required feature.

G. Assign alarm messages to system messages including point's alarm condition, points off-normal condition.

H. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

I. System shall be capable of grouping alarms into different categories and each category shall be assignable to a phone number or email address.

J. System shall be configured and installed to call phone numbers and to sent emails and text messages when an alarm is activated.

2.9 TIME SCHEDULES

A. All time schedules shall have an optimization feature. The maximum start or stop optimization shall be 2 hours. Optimization shall take into consideration longer time in the schedule has been off for longer than 36 hours. Optimized start shall bring all space set points within 1 deg F of set point prior to normal schedule start.

B. Provide graphics based scheduling control of all systems specified in the control sequences as being controlled via a schedule.

C. Automatically initiate equipment or system commands, based on preselected time schedule for points specified.

D. Provide program times for each day of week, per point, with one-minute resolution.

E. Provide for holidays, minimum of 5 consecutive holidays.

F. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

G. Coordinate initial schedule parameters with Owner prior to Substantial Completion.

H. Interlocking: Permit events to occur, based on changing condition of one or more associated master points.

2.10 REPORTS AND LOGS

A. Operator shall be able to select, to modify, to create, and to print reports and logs. Report data shall be stored and used in a format accessible by standard spreadsheet and word processing programs.

B. Standard Reports. Furnish the following standard system reports:
   1. 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.
   2. Alarm Summary. Current alarms and closed alarms. System shall permanently retain closed alarms.
   3. Logs. System shall log the following to a database or text file and shall permanently retain data.
      a. Alarm History
      b. Trend Data. Operator shall be able to select trends to be logged.
      c. 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.

2.11 STANDARD ENERGY REPORTS

A. Provide an intuitive, easily configured report tool with the Building Automation workstation that allows the user to create as a minimum the energy reports detailed below.

B. The energy reporting tools shall be accessible through any type of browser (Internet Explorer, Firefox, etc) and be very user intuitive for the end-use customer. The energy reporting tool shall be pre-configured by the BAS contractor to interrogate all metered data in the BAS historical trends database using BACnet/IP, Web-Services, SQL Query Language or other open mechanisms.

C. Metered data shall be stored at 5 minute intervals for consumption and demand for each metered energy source unless specified otherwise. Energy data shall be stored and available for a period not less than five years in an SQL or Oracle Database. Only SQL, MS SQL or Opensource SQL, and Oracle databases are acceptable for storage of energy data.

D. The DDC controls contractor shall be responsible for all configurations of the Energy and Environmental Performance reporting tool. No knowledge of Databases, SQL queries or any programming language shall be required by the end-user customer to generate energy reports.

E. Metered sources shall be shown for each building in a 'tree' configuration and data ranges selected on the fly by using an easy-to-use calendar control. Additionally, there shall be a 'compare to' calendar, so that one time period can easily be compared to another period, e.g. 2010 annual consumption to 2011 consumption annual.

F. Additionally, the end-user shall be able to schedule configured energy reports to run on a recurring basis: For example, a monthly consumption report shall be scheduled to automatically be generated on the first Monday of the following month, archived on the server in both Adobe PDF and Microsoft Excel, and automatically emailed to designated personnel in the end-user organization.
   1. Energy Reports Types:
      a. Consumption
      b. Demand
   2. Metered Energy Sources:
      a. Electricity, Gas
   3. Energy Report Graphs formats
      a. Bar, Line, Totalized, Pie and tabular data
      b. Engineering Units and Normalized Data available in graphical formats.
      c. Kwh (MWH)
      d. KBtu/hr
      e. Kwh/square foot
      f. KBtu/hr/square foot/year
      g. Kwh/square foot/occupied hour
      h. Lbs CO2
      i. Lbs CO2/sq. ft.

G. Low/Average/High data shall be optionally displayed on the graph by licking an appropriate button on a chart toolbar.

H. Benchmarking shall be incorporated into the energy reporting tool, allowing the customer to enter utility data for any periods prior to the presence of meters connected to the BAS. If the benchmark data has been entered, it shall be optionally be shown on the same graph by clicking and appropriate button on the chart toolbar.

I. Cooling and Heating Degree Days data shall be optionally shown graphically on top of the consumption graphs, by clicking an appropriate button in a tool bar.

J. Occupied/Unoccupied energy consumption shall be displayed by use of color. For example, a monthly consumption report shown by day shall display unoccupied usage in a different color to occupied usage.

2.12 LOCAL AREA NETWORKS (LAN):

A. Coordinate with Owner on single point network jack location. All network wiring within the building is the responsibility of the TCC.

B. Furnish communication between control units over local area network (LAN).

C. LAN Capacity: Not less than 32 stations or nodes.

D. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

E. LAN Data Speed: Minimum 19.2 Kb.

F. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

G. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

H. Network Support: Time for global point to be received by any station, less than 3 seconds. Furnish automatic reconfiguration when station is added or lost. In event transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.13 PROGRAMMING APPLICATION FEATURES

A. Alarm Messages:
   1. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totaled point's warning limit, and hardware elements advisories.
   2. Output assigned alarm with "message requiring acknowledgment".
   3. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify conditioned power supply is available to control units and to operator workstation.

B. Verify field end devices and wiring is installed prior to installation proceeding.

3.2 INSTALLATION

A. Install in accordance with ASHRAE 135.

B. Perform all setup and installation procedures necessary to provide a complete and operating workstation and portable operator's terminal. Coordinate with Owner's IT manager as necessary for network connections, etc.

C. Install in accordance with all manufacturer's recommendations for equipment provided under this Contract.

D. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

E. Install software in control units and in operator workstation. Implement features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

F. Install conduit and electrical wiring in accordance with Section 26 05 03.

G. Install electrical material and installation in accordance with appropriate requirements of Division 26.

H. Install sensors according to manufacturer's recommendations.

I. Install outdoor air temperature sensors on north wall at designated location with sun shield.

J. Mount sensors rigidly and adequately for operating environment.

K. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

L. Smoke detectors, freezestats and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Auto reset on all switches shall be in a visible, easily accessible location. Provide isolated contacts that allow DDC software to monitor safety switch.

M. Seal wall penetrations to prevent sensor readings from being affected by air transmitted from other areas.

N. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

O. Install mixing plenum low limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m^2 (1 ft^2) of coil area.

P. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

Q. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.

R. Supply Duct Static Pressure Transmitter.
1. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
2. Pipe from sensor to temperature control panel.
3. Locate Static Pressure Sensing Probe ¾ of the distance of the longest duct run away from the air system.
4. Label ceiling grid for probe location.
5. Inputs to pressure transmitter shall be duct static pressure and nearest space served by air system.

S. Supply Fan High Static Pressure Probe:
1. Install a static pressure probe located in the air handling unit main discharge duct at least six feet or as far as physically possible downstream of the fan and upstream of any dampers and pipe to a differential pressure switch located in the temperature control panel. Wire in series with the safety circuit of the supply and return fan.

T. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.

U. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.

3.3 ADJUSTING & CHECKOUT

A. Adjust all set points, alarm points, and display configurations so the BAS performs as specified and as required by the test and balance contractor.

B. Test each sequence of BAS by simulation of normal, off normal, and alarm conditions.

C. TCC shall provide a documented checkout procedure when installation is complete. Check out shall consist of at least two field technicians verifying functional operation of all control devices.

D. When this verification process is complete, the TCC shall submit a Control Readiness Letter. See sample at the end of this section.

E. Where this contract requires commissioning, this contractor shall participate as the BAS integrator as defined in other specification sections. In any case, this contractor shall cooperate fully to provide verification to the commissioning authority or the engineer that the system is in conformance with the design intent as expressed in the contract.

F. Enter BAS database and furnish backup copy on CD. During the maintenance service period, provide updated copies of the CD as changes are made to the system.

G. Adjust alarm points to eliminate any nuisance alarms.

3.4 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow adequate time for start-up and commissioning prior to placing control systems in permanent operation.

B. Furnish service technician employed by system installer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

3.5 DEMONSTRATION AND TRAINING

A. The Temperature Control Contractor shall provide the training syllabus and location shall be approved by the Owner, the Commissioning Agent, and Engineer one calendar month prior to the training.

1. HVAC system overview.
2. Operation of control system.
3. Function of each component.
4. System operating procedures.
5. Programming procedures.
6. Maintenance procedures.

B. Furnish basic operator training for three persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 24 hours instructor time. Furnish training on site.

C. Demonstrate complete and operating system to Owner.

D. Video record all training and distribute copies on DVD to Owner and Engineer.

END OF SECTION

CONTROLS READINESS LETTER

I hereby certify the following have been completed:

A. ALL HVAC EQUIPMENT AND RELATED CONTROLS HAVE BEEN VERIFIED AS INSTALLED AND/OR CONNECTED.

B. All DDC components are labeled and have the covers installed.

C. All standalone and computer based equipment and related controls have been tested for connection and operation.

D. All DDC control software is INSTALLED, PROGRAMMED and TESTED for proper control sequence operation.

E. All DDC front end computer graphics are PROGRAMMED, TESTED, and in automatic ('hands-off') operation.

F. All equipment intended for time schedule based or interlocked operation is programmed to run accordingly and has been verified. Specifically, all equipment is in automatic operation, no manual control is acceptable.

G. Required DDC system access (password, rights, etc.) is available on site through the building engineer or turned over system documentation.

H. All DDC controlled equipment is configured for proper display and testability.

I. All operating functions are easily operator overridable to facilitate testability including but not limited to set points, sensors, and actuators.

J. All control sequences have their related set point, sensor, and resultant action on the screen and in a useful proximity to each other.

K. All alarm limits, if used, are programmed to appropriate values for normal use and minimize false alarms.

L. Motor status points are be configured and set to indicate actual belt/coupler break conditions.

M. If text and graphic formats are available on the BAS computer front end both operator display options are equally complete and matched for displaying the above items.

Exceptions to the above readiness for commissioning/punchlist are listed and described below.

Signature affirms that the above items are, to the best of my knowledge, true and ready to be verified by the engineer or commissioning agent. I hereby agree to pay all additional costs accumulated by the engineer/owner during the commissioning/punchlist process due to incomplete work as described above.

Project Manager:

Project:

Controls Technician:

Phone Number:

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:
   1. General:
      a. Zone Sensors
      b. Building Sensors
   2. Hot Water Systems:
      a. Boiler Plant
      b. Hot Water Circulation Loop
   3. Chilled Water Systems:
      a. Chiller Plant
      b. Chilled Water Circulation Loop
      c. Heat Exchanger – High-Temperature Chilled Water
      d. High-Temperature Chilled Water Loop
   4. Primary Air Systems:
      a. Air Handling Unit (AHU) With HW And CHW– Multi-Zone VAV
      b. Air Handling Unit (AHU) With HW And CHW– Induction Displacement
      c. Air Handling Unit (AHU) With HW And CHW– Single-Zone VAV
   5. Terminal Air Systems:
      a. Air Terminal Units – Single-Duct VAV Boxes With HW Reheat
      b. Air Terminal Units – Induction Displacement Units (IDU) With HW And CHW
      c. Air Terminal Units – Active Chilled Beams (ACB) With HW And CHW
      d. Exhaust Fans
      e. Destratification Fans
      f. Unit Heaters and Cabinet Unit Heaters
   6. Miscellaneous Systems:
      a. Domestic Hot Water
      b. Exterior Lighting
      c. Utility Metering

B. Related Sections:
   1. Section 23 09 00 - Instrumentation and Control for HVAC: For equipment, devices, and system components to implement sequences of operation.
   2. Section 23 09 23 - Direct-Digital Control System for HVAC: For equipment, devices, system components, and software to implement sequences of operation.

1.2 SYSTEM DESCRIPTION

A. The Temperature Controls Contractor (TCC) is responsible for items in this Section.

1.3 DEFINITIONS

A. ACB – Active Chilled Beam

B. AI – Analog Input.

C. AO – Analog Output.

D. BAS – Building Automation and Control System.

E. BI – Binary (Digital) Input.

F. BO – Binary (Digital) Output.

G. CMS – Chiller Management System.

H. CCV – Cooling Coil Valve.

I. CHW – Chilled Water

J. DAT – Discharge Air Temperature

K. EA – Exhaust Air

L. EAT – Entering Air Temperature

M. EWT - Entering Water Temperature

N. GUI – Graphical User Interface.

O. HCHW – High-Temperature Chilled Water

P. HCV – Heating Coil Valve.

Q. IDU – Induction Displacement Units

R. LAT – Leaving Air Temperature

S. LWT – Leaving Water Temperature

T. OA – Outdoor Air

U. OAF – Outdoor Air Flow

V. OAT – Outdoor Air Temperature

W. BMS – Proprietary Boiler Management System.

X. PI Loop – Proportional-Integral Loop

Y. PID Loop - Proportional-Integral-Derivative Loop

Z. RA – Return Air

AA. SWT – Supply Water Temperature

BB. ZAT – Zone Air Temperature

1.4 SUBMITTALS

A. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
   2. Submit flow diagrams for each control system, graphically depicting control logic.
   3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
   4. Coordinate submittals with information requested in Section 23 09 00and Section 23 09 23 .

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and setpoint of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. ALARMS, SETPOINTS, AND TIMERS

1. All Setpoints, Timers and Alarms listed in this Section shall be adjustable by Owner.

2. All Nuisance Alarms shall be corrected prior to Project Closeout.

B. TEMPERATURE AND HUMIDITY

1. ZONE SENSORS:

a. ALARM SCHEDULE:

1) All Zone Sensors shall have alarms. The zone temperature alarm setpoints shall be dynamically based upon the mode of operation. The BAS shall generate an alarm when:

2) The zone temperature is 2 degrees F below the occupied and unoccupied zone heating setpoint after a 5-minute delay.

3) The zone temperature is 2 degrees F above the occupied and unoccupied zone cooling setpoint after a 5-minute delay.

b. INPUTS:

1) Zone Air Temperature

2. AMBIENT BUILDING SENSORS:

a. BAS BUILDING SENSORS:

1) ONE (1) Outdoor Ambient Temperature Sensor.

a) Sensor shall be backup to BMS Outdoor Ambient Temperature Sensor in the event the BMS sensor fails.

b) BMS sensor to be BAS master sensor.

2) ONE (1) Outdoor Ambient Humidity Sensor.

3) ONE (1) Outdoor Ambient CO_2 Sensor.

b. ALARMS:

1) OUTDOOR AMBIENT AIR TEMPERATURE:

a) LOW TEMPERATURE ALARM: Sensor is below negative 45 degrees F after a 15-minute delay.

b) HIGH TEMPERATURE ALARM: Sensor is above 125 degrees F after a 15-minute delay.

2) OUTDOOR AMBIENT HUMIDITY:

a) LOW HUMIDITY ALARM: Sensor is below 15 percent RH after a 1-hour delay.

b) HIGH HUMIDITY ALARM: Sensor is above 98 percent RH after a 1-hour delay.

3) OUTDOOR AMBIENT CO_2 CONCENTRATION:

a) LOW CO_2 ALARM: Sensor is below 250 PPM after a 1-hour delay.

b) HIGH CO_2 ALARM: Sensor is above 1000 PPM for after a 1-hour delay.

c. INPUTS:

1) BMS Outdoor Ambient Air Temperature (Global Master)

2) BAS Outdoor Ambient Air Temperature (Backup)

3) Outdoor Ambient Humidity [RH]

4) Outdoor Ambient Dew Point (calculated)

5) Outdoor Ambient CO_2 Concentration [PPM]

3.2 HOT WATER SYSTEMS

A. BOILER PLANT:

1. PROPRIETARY BOILER MANAGEMENT SYSTEM (BMS):

a. The Plant shall by controlled by the manufacturer's BMS (Fulton Modsync). System to be furnished with Boilers. Refer to Section 23 52 35.

b. BMS (Fulton Modsync) shall have graphically displayed, monitored, and trend data via a BACnet interface card.

2. TIME SCHEDULE:

a. The Plant shall have a dedicated Time Schedule.

3. OPERATING MODES:

a. OCCUPIED MODE:

1) The Plant shall be in this mode when Time Schedule is ON.

b. UNOCCUPIED MODE:
   1) The Plant shall be in this mode when Time Schedule is OFF.
c. DEHUMIDIFICATION REHEAT MODE:
   1) The Plant shall be in this mode when ONE (adjustable) or more associated AHUs make a DEHUMIDIFICATION REHEAT REQUEST.
   2) This mode shall override any other mode.
   3) Refer to AIR HANDLING UNIT (AHU) – MULTI-ZONE Sequence.

4. BOILER ENABLE:

a. The Plant shall be ENABLED when ANY of the following are TRUE:
   1) The Outdoor Air Temperature is less than the Boiler Enable Setpoint.
   2) DEHUMIDIFICATION REHEAT MODE is ON:
   3) BOILER ENABLE OVERRIDE is ON
b. The Plant shall be DISABLED when ALL of the following are TRUE:
   1) The Outdoor Air Temperature exceeds Boiler Enable Setpoint Hysteresis.
   2) DEHUMIDIFICATION REHEAT MODE is OFF.
   3) BOILER ENABLE OVERRIDE is OFF
c. BOILER ENABLE SETPOINT:
   1) Setpoint: 65 degrees F (adjustable).
   2) Hysteresis: 5 degrees F (adjustable).
d. BOILER ENABLE OVERRIDE:
   1) Provide a binary data enable point to enable/disable OVERRIDE of the BOILER ENABLE.
e. BOILER ENABLE TIMERS:
      a) Minimum ON Time: 15 minutes (adjustable).
      b) Minimum OFF Time: 30 minutes (adjustable).
      c) Timers shall be overridden when any AHU enters OPTIMAL START MODE.
      d) Timer values shall not be less than Manufacturer's recommended values.

5. BOILER LEAD/LAG CYCLE:

a. LEAD Boiler shall be cycled to LAG Boiler to maintain equivalent run hours.
b. LEAD/LAG CYCLE INTERVAL: 20 cycles (Adjustable).

6. SUPPLY WATER TEMPERATURE CONTROL:

a. The BMS shall maintain Supply Water Temperature (SWT) Control by the following means:
   1) STAGE 1: PROVE water circulation pump is ON.
   2) STAGE 2: LEAD Boiler is ON and maintained at LOW-FIRE.
   3) STAGE 3: LAG Boiler is ON and maintained at LOW-FIRE.
      a) Continue with any additional LAG Boilers.
   4) STAGE 4: ALL Boilers modulate together at lowest Firing Rate.
b. SWT SETPOINTS:
   1) OCCUPIED MODE:
      a) STARTUP: OAT-Based. See below Sequence.
      b) MAXIMUM: 160 degrees F (adjustable).
      c) MINIMUM: 120 degrees F (adjustable).
      d) HYSTERESIS: 10 degrees F (adjustable).
c. SWT RESET – OUTDOOR AIR TEMPERATURE (OAT):
   1) SWT shall linearly reset inversely between MAXIMUM and MINIMUM Setpoints when the OAT is within the Reset Range.
   2) OAT Reset Range:
      a) MAXIMUM: 50 degrees F (adjustable).
      b) MINIMUM: 0 degrees F (adjustable).
   3) Provide reference graphic on BAS depicting SWT versus the Outdoor Air Temperature.

7. ALARMS:

a. NUISANCE ALARMS: Time Delays and Setpoints shall be adjusted to eliminate Nuisance Alarms.
b. HOT WATER SUPPLY WATER TEMPERATURE:
1) LOW TEMPERATURE ALARM: Boiler LWT is below 80 degrees F (adjustable) when Plant is ENABLED after a 15-minute delay (adjustable).
2) HIGH TEMPERATURE ALARM: Boiler LWT is above 180 degrees F (adjustable) when Plant is ENABLED after a 1-minute delay (adjustable).
c. BOILER FEEDBACK:
1) BOILER OFF ALARM: Boiler ENABLE ON, Boiler Status OFF after delay.
2) BOILER ON ALARM: Boiler ENABLE OFF, Boiler Status ON after delay.
d. BMS ALARM STATUS:
1) BMS FAULT ALARM: Boiler BMS Fault.

8. INPUT/OUTPUT SCHEDULE:

a. INPUTS:
1) Boiler Plant Outdoor Air Temperature
2) Supply Water Temperature
3) Per Boiler:
a) Boiler Local/Remote Switch
b) Boiler Run Status
c) Boiler Alarm Status
d) Boiler Outlet Temperature
e) Boiler Firing Rate
f) Boiler Run Hours
b. OUTPUTS:
1) Boiler Enable/Disable
2) Water Temperature Setpoint
3) Water Available Status
4) Operating Modes:
a) Occupied Mode
b) Unoccupied Mode
c) Dehumidification Mode

B. **HOT WATER CIRCULATION LOOP**

1. GENERAL:

a. HW Pumps shall be controlled by the BAS. The BMS shall monitor the Pump Status.

2. PUMP STATUS:

a. Provide a VFD Motor Current Value for the Pump. The BAS shall determine Pump Status by comparing the Motor Current to the Pump ON Setpoint.

3. PUMP OPERATION:

a. LEAD Pump ON when:
1) Boiler is ENABLED.
b. LEAD Pump OFF when:
1) Boiler is DISABLED.
c. LAG Pump ON when:
1) LAG Pump to remain OFF unless LEAD PUMP OFF ALARM is activated.
d. LAG PUMP OFF when:
1) LEAD PUMP OFF ALARM is deactivated.

4. LEAD/LAG CYCLE:

a. LEAD Pump shall be cycled to LAG Pump to maintain equivalent run hours.
b. LEAD/LAG CYCLE INTERVAL: 30 days (adjustable).

5. PUMP SPEED:

a. Modulate the LEAD Pump VFD to maintain Water Loop Pressure Setpoint.
b. The Water Loop Pressure Transmitter shall be installed per Section 23 09 00.

c. MINIMUM FLOW:
    1) Pump shall modulate down to the Minimum Flow Setpoint.
    2) MINIMUM FLOW SETPOINT:
        a) Per Boiler Manufacturer's Requirement (NOT adjustable).
            (1) MINIMUM FLOW SETPOINT shall be reset by the number of Boilers ENABLED.
        b) If no value provided by Boiler Manufacturer, value shall be determined by TAB Contractor (default of 15 Hz).

d. DIFFERENTIAL PRESSURE RESET:
    1) Pump to operate at lowest speed and pressure to satisfy current load. A PID loop will reset the remote differential pressure (DP) setpoint.
    2) Reset DP Setpoint Lower:
        a) Reduce DP Setpoint when ZERO (adjustable) Control Valve Pressure Requests are active.
    3) Reset DP Setpoint Higher:
        a) Increase DP Setpoint when ONE (adjustable) or more Control Valve Pressure Requests are active.
    4) DP Setpoint Increment:
        a) Decrease: 0.5 PSI (adjustable).
        b) Increase: 0.5 PSI (adjustable).
    5) DP Setpoint Range:
        a) Minimum: 5 PSI (adjustable).
        b) Maximum: As determined by TAB Contractor to satisfy the worst-case Coil at Design Conditions.
            (1) Default Value: Design Coil Pressure Drop plus Control Valve Pressure Drop at DP Transmitter location (approximately 15 PSI).
        c) Startup: 15 PSI (adjustable).
    6) Poll Timer: 5 minutes (adjustable).
        a) Poll Timer to reset whenever the SWT Setpoint is reset.
    7) Control Valve Pressure Request:
        a) Refer to AHU, Air Terminal Unit, and Unit Heater Sequences.

6. ALARM SCHEDULE:

a. PUMPS:
    1) PUMP OFF ALARM: Pump Commanded ON, Pump Status OFF, 5-minute delay (adjustable)
    2) PUMP ON ALARM: Pump Commanded OFF, Pump Status ON, 5-minute delay (adjustable)
    3) PUMP FEEDBACK ALARM: Pump Commanded ON, Pump Motor Current Status less than Setpoint. , 5-minute delay (adjustable)

b. LOOP PRESSURE:
    1) HIGH LOOP PRESSURE ALARM: Loop System Pressure grater than 35 PSI (adjustable) after 5-minute delay (adjustable).
    2) LOOP DIFFERENTIAL PRESSURE TRANSMITTER FEEDBACK ALARM: Pump ON and VFD commanded to maintain Differential Pressure, Differential Pressure Setpoint deviates by 10 PSI (adjustable) after 5-minute delay (adjustable).

c. LOOP WATER TEMPERATURE SENSOR:
    1) HIGH TEMPERATURE ALARM: Temperature above 180 degrees F (adjustable) , 5-minute delay (adjustable)
    2) LOW TEMPERATURE ALARM: Temperature below 60 degrees F (adjustable) , 5-minute delay (adjustable)

7. INPUT/OUTPUT SCHEDULE:

a. Coordinate with the Boiler Manufacturer to identify and integrate the required BACnet points.

b. INPUTS
    1) Water Loop Supply Temp (Immersion Well)
    2) Water Loop Return Temp (Immersion Well)
    3) Water Loop Differential Pressure
    4) Water Loop System Pressure
    5) Per Pump:
        a) Pump Amps (Status)
    6) Per Boiler:
        a) Isolation Valve Status
c. OUTPUTS
    1) Boiler Plant Enable
    2) Per Pump:
        a) Pump Command (Start/Stop)
        b) Pump Speed Modulation

3.3 CHILLED WATER SYSTEMS

A. CHILLER PLANT:

1. CHILLER CONTROL SYSTEM (CCS):

a. The Plant shall by controlled by the manufacturer's CCS. System to be furnished with Chiller. Refer to Section 23 63 13.
b. Plant to be provided with a BACnet interface card.

2. TIME SCHEDULE:

a. The Plant shall have a dedicated Time Schedule.

3. OPERATING MODES:

a. OCCUPIED MODE:
    1) The Plant shall be in this mode when Time Schedule is ON.
b. UNOCCUPIED MODE:
    1) The Plant shall be in this mode when Time Schedule is OFF.
c. LOAD LIMIT MODE:
    1) The Plant shall enter this mode during Startup. Refer to Startup Control sequence below.
d. DEHUMIDIFICATION MODE:
    1) The Plant shall be in this mode when ONE (adjustable) or more associated AHUs make a DEHUMIDIFICATION REQUEST.
    2) This mode shall override any other mode.
    3) Refer to AIR HANDLING UNIT (AHU) – MULTI-ZONE Sequence.

4. CHILLER ENABLE:

a. The Plant shall be ENABLED when ANY of the following are TRUE:
    1) The Outdoor Air Temperature is above the Chiller Enable Setpoint.
    2) DEHUMIDIFICATION MODE is ON.
    3) CHILLER ENABLE OVERRIDE is ON
b. The Plant shall be DISABLED when ALL of the following are TRUE:
    1) The Outdoor Air Temperature below the Chiller Enable Setpoint Hysteresis.
    2) Less than TWO (adjustable) Control Valve Temperature Requests are active.
    3) DEHUMIDIFICATION MODE is OFF.
    4) CHILLER ENABLE OVERRIDE is OFF.
c. CHILLER ENABLE SETPOINT:
    1) Setpoint: 20 degrees F (adjustable) above Chiller Manufacturer's Low Ambient Cutout Temperature.
    2) Hysteresis: 5 degrees F (adjustable).
d. CHILLER ENABLE OVERRIDE:
    1) Provide a binary data enable point to enable/disable OVERRIDE of the CHILLER ENABLE.

e. CHILLER ENABLE TIMERS:
    a) Minimum ON Time: 30 minutes (adjustable).
    b) Active Minimum OFF Time: 30 minutes (adjustable).
    c) Inactive Minimum OFF Time: 60 minutes (adjustable).
    d) Timers shall be overridden when any AHU enters OPTIMAL START MODE.
    e) Timer values shall not be less than Manufacturer's recommended values.

5. CHILLER STARTUP CONTROL:

a. LOAD LIMIT MODE:
    1) Intent: Limit electrical demand [kW] draw from Electrical Utility to minimize monthly demand charges.
    2) Upon initial startup, limit the operating capacity to STARTUP CAPACITY SETPOINT and linearly increase the CAPACITY SETPOINT over the duration of the LOAD LIMIT TIMER.
    3) The LOAD LIMIT sequence to end when EITHER following are TRUE:
        a) The LOAD LIMIT TIMER expires.
        b) The STARTUP SWT Setpoint is met.
b. STARTUP CAPACITY SETPOINT: Minimum allowable value per Chiller Manufacturer.
c. MAXIMUM CAPACITY SETPOINT: 80 percent (adjustable).
d. LOAD LIMIT TIMER: 30 minutes (adjustable).
    1) Shall not be less than the Electrical Utility demand charge interval (default is 15 minutes)

6. SUPPLY WATER TEMPERATURE CONTROL:

a. The Chiller maintains Supply Water Temperature (SWT) Control by modulating the Chiller capacity.
b. SWT SETPOINTS:
    1) OCCUPIED MODE:
        a) STARTUP: 44 degrees F (adjustable).
        b) MAXIMUM: 54 degrees F (adjustable).
        c) MINIMUM: 42 degrees F (adjustable).
        d) HYSTERESIS: 2 degrees F (adjustable).
    2) UNOCCUPIED MODE:
        a) STARTUP: 50 degrees F (adjustable).
        b) HYSTERESIS: 4 degrees F (adjustable).
    3) DEHUMIDIFICATION MODE:
        a) STARTUP: 42 degrees F (adjustable).
        b) MAXIMUM: 46 degrees F (adjustable).
        c) MINIMUM: 42 degrees F (adjustable).
        d) HYSTERESIS: 2 degrees F (adjustable).
c. SWT RESET – LOAD-BASED:
    1) A PID loop shall linearly reset the SWT between MAXIMUM and MINIMUM Setpoints per the Reset Sequence.
    2) SWT Reset Enabled:
        a) Enable SWT Reset once LOAD LIMIT sequence is complete.
    3) Reset SWT Lower:
        a) Reduce SWT when TWO (adjustable) or more Control Valve Temperature Requests are active.
    4) Reset SWT Higher:
        a) Increase SWT when ZERO (adjustable) Control Valve Temperature Requests are active.
    5) SWT RESET INCREMENT: 0.5 degree F (adjustable).
    6) POLL TIMER:
        a) STANDARD MODE: 30 minutes (adjustable).
        b) DEHUMIDIFICATION MODE: 15 minutes (adjustable).
        c) RESET: Poll Timer shall reset any time Plant enters DEHUMIDIFICATION MODE.

7) Control Valve Temperature Request:
   a) Refer to AIR HANDLING UNIT (AHU) – MULTI-ZONE and HIGH-TEMPERATURE CHILLED WATER HEAT EXCHANGER Sequence.

7. ALARMS:

a. NUISANCE ALARMS: Time Delays and Setpoints shall be adjusted to eliminate Nuisance Alarms.

b. CHILLED WATER SUPPLY WATER TEMPERATURE:
   1) LOW TEMPERATURE ALARM: SWT is below 40 degrees F (adjustable) when Plant is ENABLED after a 15-minute delay (adjustable).
   2) HIGH TEMPERATURE ALARM: SWT is above 60 degrees F (adjustable) when Plant is ENABLED after a 15-minute delay (adjustable).

c. CHILLER FEEDBACK:
   1) CHILLER OFF ALARM: Chiller ENABLE ON, Chiller Status OFF after delay.
   2) CHILLER ON ALARM: Chiller ENABLE OFF, Chiller Status ON after delay.

d. BACnet Interface Card ALARMS and FAULT CODES: Refer to below.

8. INPUTS/OUTPUTS SCHEDULE

a. INPUTS:
   1) The Chiller BACnet Interface Card shall provide the following data for the BAS GUI:
      a) Setpoint Cooling
      b) Load Limit Stage
      c) Stop/Start Command
      d) Chiller Return Water Temp
      e) Chiller Supply Water Temp
      f) Outdoor Air Temp
      g) System 1 Operational Code
      h) System 1 Fault Code
      i) System 2 Operational Code
      j) System 2 Fault Code
      k) System 1 Alarm
      l) System 2 Alarm
      m) Lead System
      n) Control Mode
      o) Flow Switch Status
      p) Compressor Amps
   2) The Chiller BACnet Interface Card shall provide the following data, but shall not be part of the GUI for the Operators. The BAS shall make the data available for servicing and or troubleshooting.
      a) System 1 Suction Pressure
      b) System 1 Discharge Pressure
      c) System 2 Suction Pressure
      d) System 2 Discharge Pressure
      e) System 1 Condenser Fan Stage
      f) System 2 Condenser Fan Stage
      g) System 1 Comp 1 Run
      h) System 2 Comp 2 Run
      i) System 1 LLSV
      j) System 1 Hot Gas Bypass Valve
      k) System 1 Comp 2 Run
      l) System 2 Comp 2 Run
      m) System 2 LLSV
      n) Ambient Control Mode
   3) OPERATIONAL CODES:

a) The following Operational Codes shall be calculated and the text displayed on the system GUI and logged in the event log when the operational code changes. Coordinate with manufacturer.

Table A – Operational Codes			
Code #:	**Text description**	**Code #:**	**Text description**
0	No abnormal condition	9	No Cool Load
1	Unit Switch off	10	Anti-Coincidence Timer Active
2	System Switch Off	11	Anti-Recycle Timer Active
3	Lock-out	12	Manual Override
4	Unit Fault	13	Suction Limiting
5	System Fault	14	Discharge Limiting
6	Remote Shutdown	15	Current Limiting
7	Daily Shutdown	16	Load Limiting
8	No Run Permissive	17	Compressor(s) Running

4) FAULT CODES:

a) The following Fault Codes shall be calculated and the text displayed on the system GUI and logged in the event log when the operational code changes. Coordinate with manufacturer.

Table B – Fault Codes			
Code #:	**Text description**	**Code #:**	**Text description**
0	No Fault	15	Motor Current Unbalanced
1	VAC Under Voltage	16	Low Differential Oil Pressure
2	Low Ambient Temperature	17	Ground Fault
3	High Ambient Temperature	18	MP/HPCO Fault
4	Low Leaving Chilled Liquid Temp	19	Low Evaporator Temperature
5	High discharge Pressure	20	Incorrect Refrigerant Programmed
6	High Differential Oil Pressure	21	Power Failure Manual Reset
7	Low suction Pressure	22	Unit Motor Current
8	High Motor Current	23	Low Superheat
9	LLSV Not On	24	Sensor Fault
10	Low Battery Warning	25	Discharge Inhibit
11	High Oil Temp	26	MP/HPCO Inhibit
12	High Discharge Temp	27	Pump Trip
13	Improper Phase Rotation	28	Pump Fail Make Flow
14	Low Motor Current	29	High Ambient Temp

b. OUTPUTS:

1) Chiller Enable/Disable
2) Water Temperature Setpoint
3) Water Available Status
4) Operating Modes:
   a) Occupied Mode
   b) Unoccupied Mode
   c) Load Limit Mode
   d) Dehumidification Mode

B. CHILLED WATER CIRCULATION LOOP

1. GENERAL:

a. Refer to HOT WATER CIRCULATION LOOP for standard sequence. Below are variances applicable to the CHILLED WATER CIRCULATION LOOP.

2. PUMP OPERATION:

a. LEAD Pump ON when:
   1) Chiller Plant is ENABLED.

b. LEAD Pump OFF when BOTH of the following are TRUE:
   1) Chiller Plant is DISABLED.
   2) Compressor Run-Down Timer is EXPIRED.

c. LEAD Pump ON when:
   1) When the Chiller Plant is ENABLED.

d. LEAD Pump OFF when:
   1) When the Chiller Plant is DISABLED.

e. Compressor Run-Down Timer: 5 minutes (adjustable).

3. PUMP SPEED:

a. MINIMUM FLOW:
   1) MINIMUM FLOW SETPOINT:
      a) Per Chiller Manufacturer's Requirement (NOT adjustable).
         (1) MINIMUM FLOW SETPOINT shall be multiplied by the number of Chillers ENABLED (multiple Chillers only).

4. ALARM SCHEDULE:

a. LOOP WATER TEMPERATURE SENSOR:
   1) HIGH TEMPERATURE ALARM: Temperature above 75 degrees F (adjustable) , 5-minute delay (adjustable)
   2) LOW TEMPERATURE ALARM: Temperature below 45 degrees F (adjustable) , 5-minute delay (adjustable)

5. INPUT/OUTPUT SCHEDULE:

a. Coordinate with the Chiller Manufacturer to identify and integrate the required BACnet points.

C. HEAT EXCHANGER - HIGH-TEMPERATURE CHILLED WATER (HX-1)

1. TIME SCHEDULE:

a. The Heat Exchanger shall have a dedicated Time Schedule.

2. OPERATING MODES:

a. OCCUPIED MODE:
   1) The Heat Exchanger shall be in this mode when Time Schedule is ON.

b. UNOCCUPIED MODE:
   1) The Heat Exchanger shall be in this mode when Time Schedule is OFF.

c. DEW POINT MODE:
   1) ONE (adjustable) or more DEW POINT REQUESTS made by associated AHU.
   2) This mode shall override any other mode.
   3) Refer to AIR HANDLING UNIT (AHU) – MULTI-ZONE Sequences.

3. HEAT EXCHANGER ENABLE:

a. The Heat Exchanger shall be ENABLED when:
   1) Chiller Plant is ENABLED.

b. The Heat Exchanger shall be DISABLED when:
   1) Chiller Plant is DISABLED.

4. SUPPLY WATER TEMPERATURE CONTROL:

a. General:
   1) The Heat Exchanger will modulate the CCV to maintain the HCHW SWT.
   2) The Supply Water Temperature (SWT) must be above any System Return Air Dew Point to prevent condensation.

b. SWT SETPOINT:
   1) STARTUP: 65 degrees F (adjustable).

2) MAXIMUM: 75 degrees F (adjustable).
3) MINIMUM: 45 degrees F (adjustable).

c. SWT RESET:
1) A PID loop shall linearly reset the SWT between MAXIMUM and MINIMUM Setpoints per the Reset Sequence.
2) Reset SWT Lower:
a) Reduce SWT when ZERO (not adjustable) Dew Point Requests are active.
3) Reset SWT Higher:
a) Increase SWT when ONE (not adjustable) or more Dew Point Requests are active.
4) SWT Reset Increment: 1 degree F (adjustable).
5) Poll Timer:
a) STANDARD MODE: 15 minutes (adjustable).
b) DEW POINT MODE: 5 minute (adjustable).
c) RESET: Poll Timer shall reset any time Heat Exchanger enters DEW POINT MODE.

5. SYSTEM REQUESTS:

a. REQUESTS FOR CHILLER PLANT:
1) Control Valve Temperature Request:
a) Request Initiated: Control Valve opens above 95 percent OPEN.
b) Request Terminated: Control Valve closes below 75 percent OPEN.
c) Valve Disable: NOT USED.

6. ALARMS:

a. NUISANCE ALARMS: Time Delays and Setpoints shall be adjusted to eliminate Nuisance Alarms.
b. HIGH-TEMPERATURE CHILLED WATER SUPPLY WATER TEMPERATURE:
1) LOW TEMPERATURE ALARM: SWT is below 50 degrees F (adjustable) when Heat Exchanger is ENABLED after a 15-minute delay (adjustable).
2) HIGH TEMPERATURE ALARM: SWT is above 80 degrees F (adjustable) when Heat Exchanger is ENABLED after a 1-minute delay (adjustable).
c. DEW POINT SETPOINT:
1) LOW DEW POINT ALARM: Critical Dew Point is less than SWT for more than 15 minutes (adjustable).
d. HEAT EXCHANGER FEEDBACK:
1) HEAT EXCHANGER OFF ALARM: Heat Exchanger is ENABLED, CCV Closed after delay.

7. INPUT/OUTPUT SCHEDULE:

a. INPUTS:
1) Supply Water Temperature
b. OUTPUTS:
1) Heat Exchanger Enable/Disable
2) Water Temperature Setpoint
3) Water Available Status
4) Operating Modes:
a) Occupied Mode
b) Unoccupied Mode
c) Dehumidification Mode

D. HIGH-TEMPERATURE CHILLED WATER LOOP

1. GENERAL:

a. Refer to CHILLED WATER CIRCULATION LOOP for standard sequence. Below are variances applicable to the HIGH-TEMPERATURE CHILLED WATER CIRCULATION LOOP.

2. PUMP OPERATION:

a. LEAD Pump ON when:

1) Heat Exchanger is ENABLED.

b. LEAD Pump OFF when:

1) Heat Exchanger is DISABLED.

3. PUMP SPEED:

a. MINIMUM FLOW:

1) MINIMUM FLOW SETPOINT: 15 Hz (adjustable).

4. ALARM SCHEDULE:

a. LOOP WATER TEMPERATURE SENSOR:

1) HIGH TEMPERATURE ALARM: Temperature above 85 degrees F (adjustable) , 5-minute delay (adjustable)

2) LOW TEMPERATURE ALARM: Temperature below 49 degrees F (adjustable) , 5-minute delay (adjustable)

3.4 PRIMARY AIR SYSTEMS

A. AIR HANDLING UNIT (AHU) WITH HW AND CHW– MULTI-ZONE VAV (EX. AHUs)

1. TIME SCHEDULE:

a. Each AHU shall have a dedicated Time Schedule.

b. The Time Schedule shall control all equipment in areas served by AHU, including all Air Terminal Units, Auxiliary Heating Devices, Exhaust Fans, etc.

2. OPERATING MODES:

a. OCCUPIED MODE:

1) The AHU shall be in this mode when Time Schedule is ON.

b. UNOCCUPIED MODE:

1) The AHU shall be in this mode when Time Schedule is OFF.

c. OPTIMAL START MODE:

1) OPTIMAL START MODE shall be ENABLED when ALL of the following are TRUE:

a) AHU in UNOCCUPIED MODE.

b) Computed OPTIMAL START MODE Start Time is reached.

2) OPTIMAL START MODE shall be DISABLED when the following is TRUE:

a) AHU enters OCCUPIED MODE.

3) The computer algorithm shall determine Optimal Start Time based on the following Inputs:

a) Heating Inputs:

(1) Zone with lowest Zone Air Temperature.

(2) Outside Air Dry Bulb Temperature.

b) Cooling Inputs:

(1) Zone with highest Zone Air Temperature.

(2) Outside Air Dry Bulb Temperature.

4) Zone Disable: Provide a binary data enable point for each Zone to ENABLE/DISABLE the Zone in the algorithm.

d. DEHUMIDIFICATION MODE:

1) DEHUMIDIFICATION MODE shall be ENABLED when ALL of the following are TRUE:

a) Return Air Humidity is greater than Dehumidification Setpoint.

b) Cooling Control Valve is greater than 5 percent OPEN (adjustable).

2) DEHUMIDIFICATION MODE shall be DISABLED when the following is TRUE:

a) Return Air Humidity is less than Dehumidification Setpoint Hysteresis.

3) Dehumidification Setpoint:

a) Setpoint: 60 percent Relative Humidity (adjustable).

b) Hysteresis: 3 percent Relative Humidity (adjustable).

e. ECONOMIZER MODE:

1) ECONOMIZER MODE shall be ENABLED when ALL of the following are TRUE:

a) Outside Air Temperature is below ECONOMIZER SETPOINT.

b) DEHUMIDIFICATION MODE is DISABLED.

2) ECONOMIZER MODE shall be DISABLED when ANY of the following are TRUE:
   a) Outside Air Temperature is above HIGH-LIMIT SHUTOFF.
   b) DEHUMIDIFICATION MODE is ENABLED.
3) ECONOMIZER SETPOINT: 65 degrees F (adjustable).
   a) Note: Setpoint to be commissioned to minimize excessive dehumidification energy consumption.
4) HIGH-LIMIT SHUTOFF: 70 degrees F (adjustable).
   a) Note: MN Energy Code High Limit Shutoff value is 70 degrees F.

f. LOW TEMPERATURE OVERRIDE MODE:
1) ECONOMIZER MODE shall be ENABLED when:
   a) Discharge Air Temperature is below Low Temperature Setpoint
2) LOW TEMPERATURE SETPOINT: 45 degrees F (adjustable).
3) Refer to Outdoor Air Damper Sequence.

3. SUPPLY FAN CONTROL:

a. **FAN STATUS:**
1) Provide a VFD Motor Current Value for the Supply Fan. The BAS shall determine Supply Fan Status by comparing the Motor Current to the Fan ON Setpoint.

b. FAN OPERATION:
1) OCCUPIED MODE:
   a) Supply Fan to run continuously.
2) UNOCCUPIED MODE:
   a) Supply Fan to cycle ON when at least ONE (adjustable) Unoccupied Zone Cooling/Heating Request is received.
   b) Supply Fan to cycle OFF when ZERO (adjustable) Unoccupied Zone Cooling/Heating Requests are received.
   c) Refer to AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH REHEAT Sequence for Zone Requests.
3) OPTIMAL START MODE:
   a) Supply Fan to run continuously.
   b) Supply Fan to continue running if OPTIMAL START MODE is ENABLED during UNOCCUPIED MODE and the Fan was cycled ON.

c. **FAN SPEED:**
1) Modulate the Fan VFD to maintain the Static Pressure Setpoint as sensed by the Static Pressure Sensor.
2) Monitor Supply Airflow. Refer to Section 23 09 00 for Airflow Measuring Device requirements.
3) MINIMUM FLOW: The fan shall modulate down to a minimum flow value of 15 Hz (adjustable).
4) STATIC PRESSURE RESET:
   a) Fan to operate at lowest speed and pressure to satisfy current load. A PID loop will reset the remote Static Pressure (SP) Setpoint.
   b) Reset SP Setpoint Lower:
      (1) Reduce SP Setpoint when TWO (adjustable) or fewer Zone Pressure Requests are active.
   c) Reset SP Setpoint Higher:
      (1) Increase SP Setpoint when more than TWO (adjustable) Zone Pressure Requests are active.
   d) SP Setpoint Increment:
      (1) Decrease: 0.04 inches W.C. (adjustable).
      (2) Increase: 0.06 inches W.C. (adjustable).
   e) SP Setpoint Range:
      (1) Minimum: Minimum value shall not be less than Minimum Inlet Static Pressure requirements of any Air Terminal Unit.

(a) Default Value: 0.15 inches W.C. (adjustable).

(2) Maximum: Maximum: As determined by TAB Contractor to satisfy the worst-case Terminal Unit or Room Load at Design Conditions.

(a) Default Value: Fan Design External Static Pressure (ESP) value from Drawing Schedules.

(3) Startup: 0.80 inches W.C. (adjustable).

f) Poll Timer: 2 minutes (adjustable).

(1) Poll Timer shall be reset when DAT Setpoint is reset.

g) Zone Pressure Request:

(1) Refer to AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH REHEAT Sequence for Zone Requests.

4. RETURN FAN CONTROL:

a. **FAN STATUS:**

1) Same as Fan Status for Supply Fan.

b. FAN OPERATION:

1) RETURN FAN shall be ON when:

a) Supply Fan ON.

2) RETURN FAN shall be OFF when:

a) Supply Fan OFF.

c. **FAN SPEED:**

1) INTENT: Control Return Fan Speed is to maintain a slightly positive Building Pressure.

2) Monitor Return Airflow. Refer to Section 23 09 00 for Airflow Measuring Device requirements.

3) RETURN FAN SPEED SETPOINT:

a) OCCUPIED MODE: 90 percent (adjustable) of the difference between current Supply Fan Airflow and current Exhaust Fan Airflow. Refer to Exhaust Fan Sequence.

(1) RA = (SA – EA) * 0.90.

(2) TCC shall coordinate with the TAB Contractor to optimize this setting.

b) UNOCCUPIED MODE: Setpoint same as OCCUPIED MODE.

c) OPTIMAL START MODE: Equal to UNOCCUPIED MODE.

5. OUTDOOR AIR DAMPER CONTROL:

a. Monitor Outdoor Airflow. Refer to Section 23 09 00 for Airflow Measuring Device requirements.

b. OUTDOOR AIR (OA) DAMPER POSITION:

1) OCCUPIED MODE:

a) OA Damper shall modulate to maintain the Outdoor Air Flow (OAF) Setpoint.

2) UNOCCUPIED MODE: OA Damper is CLOSED.

3) OPTIMAL START MODE: OA Damper is CLOSED.

4) LOW TEMPERATURE OVERRIDE MODE:

a) OA Damper shall modulate closed to maintain Discharge Air Temperature. Refer to Discharge Air Temperature Sequence.

b) This MODE shall override all other OA Damper Sequences.

5) ECONOMIZER MODE:

a) OA Damper shall modulate open to maintain Discharge Air Temperature. Refer to Discharge Air Temperature Sequence.

c. OUTDOOR AIR FLOW (OAF) SETPOINT:

1) OAF SETPOINT: “CODE VALUE” from the Drawing Schedules.

2) OAF Setpoint Override:

a) The OAF Setpoint SHALL be reset LOWER when:

(1) LOW TEMPERATURE OVERRIDE MODE is ENABLED.

b) The OAF Setpoint MAY be reset HIGHER when:

(1) ECONOMIZER MODE is ENABLED.

d. DEMAND CONTROL VENTILATION – CO_2-BASED:
1) CO_2 Sensors shall be mounted in the Supply Air Duct, Return Air Duct, and Outdoor Air Inlet. Refer to Section 23 09 00.
2) Monitor Outdoor Airflow. Refer to Section 23 09 00 for Airflow Measuring Device requirements.
3) DCV MODE ENABLE:
a) The DCV MODE shall be ENABLED when ALL of the following are TRUE:
(1) DCV MANUAL DISABLE is OFF.
4) DCV MODE DISABLE:
a) The DCV MODE shall be DISABLED when ANY of the following are TRUE:
(1) DCV MANUAL DISABLE is ON.
5) DCV MANUAL DISABLE: Provide a binary data enable point to ENABLE/DISABLE DCV.
6) Discharge Air CO_2 Setpoint:
a) Discharge Air CO_2 Setpoint ($CO_{2\text{-}SA}$): Shall be the ambient Outdoor Air CO_2 concentration ($CO_{2\text{-}OA}$) level PLUS the Incremental CO_2 Setpoint:
(1) $CO_{2\text{-}DA} = CO_{2\text{-}OA} + CO_{2\text{-}INC.}$
b) Incremental CO_2 Setpoint ($CO_{2\text{-}INC.}$): Shall be determined based on the following schedule.

(1)	CLASSROOMS (AGE 9 PLUS):	625 PPM
(2)	SCIENCE LABS:	490 PPM
(3)	ART CLASSROOMS	440 PPM
(4)	MUSIC CLASSROOMS	860 PPM
(5)	MEDIA CENTERS:	570 PPM
(6)	COMPUTER LABS:	570 PPM
(7)	WOOD/METAL SHOP:	620 PPM
(8)	MULTI-USE ASSEMBLY:	1040 PPM
(9)	DINING/CAFETERIA:	1175 PPM
(10)	CONFERENCE/MEETING:	1355 PPM
(11)	LOBBIES/PREFUNCTION:	1325 PPM
(12)	OFFICE SPACE:	590 PPM
(13)	SALES:	810 PPM

c) Hysteresis: 50 PPM (adjustable).
7) OAF Setpoint Range:
a) SETPOINT: MAXIMUM of ANY of the following values:
(1) The summation of the Exhaust Fans with ON Status associated with AHU.
(2) OAF Setpoint to maintain DCV Setpoint. Refer to DCV Sequence.
b) MINIMUM SETPOINT: The "MIN CO2 SETPOINT" from the AHU Schedule on the Drawings.
c) MAXIMUM SETPOINT: "MIN CODE VALUE" from the Drawing Schedules.
(1) Prior to Commissioning, the OAF Setpoint shall not reset and maintain the MAXIMUM SETPOINT

6. RELIEF AIR DAMPER CONTROL:
a. RELIEF AIR DAMPER POSITION:
1) OCCUPIED MODE:
a) Relief Air Damper shall modulate to maintain the Relief Air Damper Setpoint.
2) UNOCCUPIED MODE: Relief Air Damper is CLOSED.
3) OPTIMAL START MODE: Relief Air Damper is CLOSED.
b. RELIEF AIR DAMPER SETPOINT:
1) LAG SETPOINT: 90 percent (adjustable) of Outdoor Air Damper position.
(1) TCC shall coordinate with the TAB Contractor to optimize this setting.

7. RETURN AIR DAMPER CONTROL:
a. RETURN AIR DAMPER POSITION:
1) OCCUPIED MODE:

a) Return Air Damper shall modulate to maintain the Return Air Damper Setpoint.
2) UNOCCUPIED MODE: Return Air Damper is 100 percent OPEN.
3) OPTIMAL START MODE: Return Air Damper is 100 percent OPEN.

b. RETURN AIR DAMPER SETPOINT:
1) Return Air Damper position shall modulate in inverse proportion to the Outdoor Air Damper position.

8. DISCHARGE AIR TEMPERATURE CONTROL:

a. The AHU shall maintain Discharge Air Temperature (DAT) Setpoint by the following means:
1) DAT is above Setpoint:
a) STAGE 1: Modulate Heating Control Valve CLOSED.
b) STAGE 2: Modulate Outdoor Air Damper (OAD) OPEN when ECONOMIZER MODE is ENABLED. Refer to ECONOMIZER MODE Sequence.
c) STAGE 3: Modulate Cooling Control Valve OPEN.
2) DAT is below Setpoint:
a) STAGE 1: Modulate Cooling Control Valve CLOSED.
b) STAGE 2: Modulate OA Damper CLOSED to Outdoor Air Flow Setpoint when ECONOMIZER MODE is ENABLED. Refer to ECONOMIZER MODE Sequence.
c) STAGE 3: Modulate Heating Control Valve OPEN.

b. DAT SETPOINTS:
1) COOLING:
a) OCCUPIED MODE: Refer to DAT Setpoint Reset Sequence.
b) DEHUMIDIFICATION MODE: Same as OCCUPIED MODE.
c) ECONOMIZER MODE: Same as OCCUPIED MODE.
d) UNOCCUPIED MODE: 60 degrees F (adjustable).
e) OPTIMAL STARTUP MODE: Same as UNOCCUPIED MODE.
2) HEATING
a) OCCUPIED MODE: Refer to DAT Setpoint Reset Sequence.
b) DEHUMIDIFICATION MODE: Not applicable to Heating.
c) ECONOMIZER MODE: Not applicable to Heating.
d) UNOCCUPIED MODE: DAT Reset MAXIMUM
e) OPTIMAL STARTUP MODE: Same as UNOCCUPIED MODE.

c. HEATING CONTROL VALVE:
1) Control Valve shall modulate to maintain DAT Setpoint.
2) Control Valve shall NOT OPEN if ANY of the following are TRUE:
a) Cooling Control Valve is OPEN
b) ECONOMIZER MODE is ENABLED. Refer to ECONOMIZE MODE Sequence.

d. COOLING CONTROL VALVE:
1) Control Valve shall modulate to maintain DAT Setpoint.
2) Control Valve shall NOT OPEN if ANY of the following are TRUE:
a) Heating Control Valve is OPEN.
b) Outdoor Air Damper is less than 100 percent OPEN when ECONOMIZER MODE is ENABLED. Refer to ECONOMIZE MODE Sequence.
c) Supply Fan is OFF.

e. DISCHARGE AIR TEMPERATURE SETPOINT RESET:
1) AHU to operate at highest Discharge Air Temperature (DAT) to satisfy current load. A PID loop will reset the DAT Setpoint.
2) DAT Setpoint Increment:
a) Decrease: 1 degree F (adjustable).
b) Increase: 1 degree F (adjustable).
3) DAT Setpoint Range:
a) STARTUP: 65 degrees F (adjustable).
b) MAXIMUM: 75 degrees F (adjustable).
c) MINIMUM: 55 degrees F (adjustable).

4) Poll Timer: 15 minutes (adjustable).
   a) Poll Timer is Reset whenever the Fan Static Pressure Setpoint is Reset.
5) COOLING MODE RESET:
   a) COOLING MODE RESET occurs when ALL of the following are TRUE:
      (1) Heating Control Valve is fully CLOSED
      (2) Supply Fan is ON.
      (3) DEHUMIDIFICATION MODE is DISABLED.
      (4) OCCUPIED MODE is Active.
   b) Reset DAT Lower:
      (1) Reduce DAT Setpoint when at least ONE (adjustable) VAV Cooling Request is Active
   c) Reset DAT Higher
      (1) Increase DAT Setpoint when ZERO (adjustable) VAV Cooling Request are Active
   d) Zone Cooling Request:
      (1) Refer to AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH REHEAT Sequence for Zone Requests.
6) HEATING MODE RESET:
   a) HEATING MODE RESET occurs when ALL of the following are TRUE:
      (1) Heating Control Valve is OPEN
      (2) Supply Fan is ON.
      (3) DEHUMIDIFICATION MODE is DISABLED.
      (4) OCCUPIED MODE is Active.
   b) Reset DAT Higher:
      (1) Increase DAT Setpoint when ALL of the following are TRUE:
         (a) ONE (adjustable) VAV Heating Request is Active.
         (b) ZERO (adjustable) VAV Cooling Requests are Active.
   c) Reset DAT Lower
      (1) Decrease DAT Setpoint when ZERO (adjustable) VAV Heating Request are Active
      (2) Poll Timer is Reset whenever the Fan Static Pressure Setpoint is Reset.
   d) Zone Heating Request:
      (1) Refer to AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH REHEAT Sequence for Zone Requests.

9. SYSTEM REQUESTS:

a. REQUESTS FOR CHILLER PLANT:
   1) Dehumidification Request:
      a) Request Initiated when BOTH are TRUE:
         (1) AHU is in DEHUMIDIFICATION MODE.
         (2) CCV opens above 85 percent OPEN.
      b) Request Terminated:
         (1) AHU is NOT in DEHUMIDIFICATION MODE.
      c) Valve Disable: NOT USED.
   2) Control Valve Temperature Request:
      a) Request Initiated: Control Valve opens above 95 percent OPEN.
      b) Request Terminated: Control Valve closes below 75 percent OPEN.
      c) Valve Disable: Provide a binary data enable point for each Valve to ENABLE/DISABLE the Control Valve in the algorithm.
         (1) AHUs serving zones with either IDUs or ACBs CANNOT be DISABLED.
         (2) Eliminate Nuisance Alarms when Valve is DISABLED.
b. REQUESTS FOR HIGH-TEMPERATURE CHILLED WATER HEAT EXCHANGER:
   1) Dew Point Requests:
      a) Implement the following only for AHUs with IDUs or ABCs.

b) Dew Point Request:
(1) Request Initiated when EITHER is TRUE:
(a) AHU Return Air Dew Point within 1 degree F ABOVE or less than SWT.
(b) AHU Discharge Air Dew Point within 1 degree F ABOVE or less than SWT.
(2) Request Terminated when BOTH are TRUE:
(a) AHU Return Air Dew Point greater than 1 degree F ABOVE SWT.
(b) AHU Discharge Air Dew Point greater than 1 degree F ABOVE SWT.
(3) Request Disable: NOT USED.

c. HOT WATER LOOP REQUESTS:
1) Control Valve Pressure Request:
a) Request Initiated: Control Valve opens above 90 percent OPEN.
b) Request Terminated: Control Valve closes below 80 percent OPEN.
c) Valve Disable: Provide a binary data enable point for each Valve to enable/disable the Control Valve in the algorithm.
(1) Eliminate Nuisance Alarms when Valve is DISABLED.

d. CHILLED WATER LOOP REQUESTS:
1) Control Valve Pressure Request:
a) Request Initiated: Control Valve opens above 90 percent OPEN.
b) Request Terminated: Control Valve closes below 80 percent OPEN.
c) Valve Disable: Provide a binary data enable point for each Valve to enable/disable the Control Valve in the algorithm.
(1) Eliminate Nuisance Alarms when Valve is DISABLED.

10. SAFETIES:

a. GENERAL:
1) ALL Safeties shall be hard wired to the Supply Fan and Return Fan Starters Or VFD Safety Circuits, as applicable.
2) ALL Safeties shall override ANY DDC control.

b. STARTER LOCKOUT:
1) Starters shall not function in the “Hand” or “Auto”
2) VFDs shall be disabled if they are indexed to the “Auto” or “Hand” position in either the VFD or bypass modes.
3) Starter or VFD shall provide Status to BAS.

c. FREEZESTAT:
1) Refer to Section 23 09 00.
2) Manual Reset.
3) Freezestat Setpoint: 35 degrees F (adjustable).
4) Generate Alarm on trip.

d. SUPPLY FAN HIGH PRESSURE LIMIT:
1) Refer to Sections 23 09 00 and 23 09 23.
2) Manual Reset.
3) High Pressure Limit Setpoint: +4.0 inches W.C. (adjustable).
4) Generate Alarm on trip.

e. SMOKE DETECTOR:
1) AHU Fans to STOP when Smoke Detector Activated.
2) Generate Alarm on trip.

11. ALARM SCHEDULE:

a. NUISANCE ALARMS: Time Delays and Setpoints shall be adjusted to eliminate Nuisance Alarms.

b. ALARM DELAY: 10 minutes (adjustable) unless indicated otherwise.

c. SUPPLY FAN:

1) FAN MANUAL ALARM: Supply Fan Commanded ON, Supply Fan Status OFF, 5-minute delay (adjustable).
2) FAN ON ALARM: Supply Fan Commanded OFF, Supply Fan Status ON, 5-minute delay (adjustable).
3) FAN FEEDBACK ALARM: Supply Fan Commanded ON, Supply Fan Motor Current Status less than Setpoint, 5-minute delay (adjustable).

d. RETURN FAN:
1) Same as Supply Fan.

e. SUPPLY DUCT STATIC PRESSURE TRANSMITTER:
1) SUPPLY DUCT SP FEEDBACK ALARM: Supply Fan ON and VFD commanded to maintain Static Pressure, Supply Duct SP Setpoint deviates by 0.5 inches W.C. (adjustable) after 5-minute delay (adjustable).

f. DISCHARGE AIR TEMPERATURE SENSOR:
1) HIGH TEMPERATURE ALARM: Temperature above 140 degrees F (adjustable).
2) LOW TEMPERATURE ALARM: Temperature below 45 degrees F (adjustable).

g. RETURN AIR HUMIDITY SENSOR:
1) HIGH HUMIDITY ALARM: Humidity above 85 percent RH (adjustable).
2) LOW HUMIDITY ALARM: Humidity below 5 percent RH (adjustable).

h. CO_2 SENSOR:
1) HIGH CO_2 ALARM: CO_2 level above 2500 PPM (adjustable).
2) LOW CO_2 ALARM: CO_2 level below 300 PPM (adjustable).
3) CO_2 FEEDBACK ALARM: CO_2 level deviates from Setpoint by 20 percent (adjustable).

i. CONTROL VALVES:
1) HEATING VALVE FEEDBACK ALARM: Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.
2) COOLING VALVE FEEDBACK ALARM: Same as Heating Valve Feedback Alarm.

j. DAMPERS:
1) OUTDOOR AIR DAMPER FEEDBACK ALARM: Damper Commanded to Position, Damper Position Status deviates from Setpoint by 10 percent (adjustable) after delay.
2) RETURN AIR DAMPER FEEDBACK ALARM: Same as Outdoor Air Damper Feedback Alarm.
3) RELIEF AIR DAMPER FEEDBACK ALARM: Same as Outdoor Air Damper Feedback Alarm.

k. SAFETIES:
1) FREEZESTAT ALARM
2) SMOKE DETECTOR ALARM
3) DUCT HIGH STATIC PRESSURE ALARM

12. INPUT/OUTPUT SCHEDULE:

a. INPUTS
1) Operating Modes:
a) Occupied/Unoccupied Mode
b) Economizer Mode
c) Dehumidification Mode
d) Optimal Start Mode
e) Low Temperature Override Mode
2) System Requests:
a) Chiller Dehumidification Request
b) Chiller CV Temperature Request
c) Heat Exchanger Dew Point Request
d) HW Loop CV Pressure Request
e) CHW Loop CV Pressure Request
3) Cooling Coil Discharge air temperature
4) Discharge Air:

a) Temperature
b) Humidity
c) Dew Point (Calculated)
d) Airflow (CFM)
e) CO_2 (PPM)

5) Return Air:
a) Temperature
b) Humidity
c) Dew Point (Calculated)
d) Airflow (CFM)
e) CO_2 (PPM)

6) Outdoor Air:
a) Airflow (CFM)

7) Mixed Air:
a) Temperature (averaging sensor)

8) Supply Fan:
a) VFD Fault
b) VFD Amps (status)

9) Return Fan:
a) VFD Fault
b) VFD Amps (status)

10) Freezestat
11) Smoke Detector
12) Duct Hi Static Alarm
13) Filter Differential Pressure

b. OUTPUTS
1) DCV Enable/Disable
2) System Requests:
a) Chiller CV Temperature Enable/Disable
b) HW Loop CV Pressure Enable/Disable
c) CHW Loop CV Pressure Enable/Disable

3) Supply Fan:
a) VFD (start/stop)
b) VFD Speed

4) Return Fan:
a) VFD (start/stop)
b) VFD Speed

5) Return Air Damper Modulation
6) Relief Air Damper Modulation
7) Outdoor Air Damper Modulation
8) Hot Water Valve Modulation
9) Chilled Water Valve Modulation

B. AIR HANDLING UNIT WITH HW AND CHW – MULTI-ZONE INDUCTION DISPLACEMENT (EX. AHUs)

1. GENERAL:

a. Refer to AIR HANDLING UNIT – MULTI-ZONE VAV for standard sequence. Below are variances applicable to AHUs with Induction Displacement Units (IDUs).

2. OPERATING MODES:

a. DEHUMIDIFICATION MODE:
1) DEHUMIDIFICATION MODE shall be ENABLED when:
a) Return Air Humidity is greater than Dehumidification Setpoint.

2) DEHUMIDIFICATION MODE shall be DISABLED when:
a) Return Air Humidity is less than Dehumidification Setpoint Hysteresis.

3) Dehumidification Setpoint:
a) Setpoint: 60 percent Relative Humidity (adjustable).
b) Hysteresis: 3 percent Relative Humidity (adjustable).

3. SUPPLY FAN CONTROL:

a. FAN SPEED:
1) Static Pressure Reset Control:
a) Fan to operate at LOWEST speed to satisfy Static Pressure (SP) Setpoint.
b) SP Setpoint Reset: SP Setpoint shall NOT be reset.
c) SP Setpoint: 0.75 inches W.C. (adjustable)
(1) TAB Contractor to determine final SP Setpoint.

4. DISCHARGE AIR TEMPERATURE CONTROL:

a. Discharge Air Temperature (DAT) must remain COOLER than the Zone Temperature to maintain the Displacement Ventilation effect.
b. HEATING CONTROL VALVE:
1) Control Valve shall modulate to maintain DAT Setpoint.
2) Control Valve shall NOT OPEN when:
a) ECONOMIZER MODE is ENABLED. Refer to ECONOMIZE MODE Sequence.
c. COOLING CONTROL VALVE:
1) Control Valve shall modulate to maintain DAT Setpoint.
2) Control Valve shall NOT OPEN if ANY of the following are TRUE:
a) Outdoor Air Damper is less than 100 percent OPEN when ECONOMIZER MODE is ENABLED. Refer to ECONOMIZE MODE Sequence.
b) Supply Fan is OFF.
d. DISCHARGE AIR TEMPERATURE SETPOINT RESET
1) COOLING MODE RESET:
a) DAT Setpoint Range:
(1) Maximum: 2 degrees F (adjustable) below Critical Zone Cooling Setpoint
(a) Critical Zone Heating Setpoint: The lowest Zone Cooling Setpoint that is calling for COOL.
(2) Minimum: 50 degrees F (adjustable).
2) HEATING MODE RESET:
a) DAT Setpoint Range:
(1) Maximum: 5 degrees F (adjustable) below Critical Zone Heating Setpoint
(a) Critical Zone Heating Setpoint: The lowest Zone Heating Setpoint that is calling for HEAT.
(2) Minimum: 50 degrees F (adjustable).

5. SYSTEM REQUESTS:

a. REQUESTS FOR BOILER PLANT:
1) Dehumidification Reheat Request:
a) Request Initiated when BOTH are TRUE:
(1) AHU is in DEHUMIDIFICATION MODE.
(2) HCV opens above 95 percent OPEN.
b) Request Terminated:
(1) AHU is NOT in DEHUMIDIFICATION MODE.
c) Valve Disable: NOT USED.
b. REQUESTS FOR HIGH-TEMPERATURE CHILLED WATER HEAT EXCHANGER:
1) Dew Point Requests:
a) Implement the following only for AHUs with IDUs or ABCs.
b) Dew Point Request:
(1) Request Initiated when EITHER is TRUE:
(a) AHU Return Air Dew Point within 1 degree F ABOVE or less than SWT.

(b) AHU Discharge Air Dew Point within 1 degree F ABOVE or less than SWT.

(2) Request Terminated when BOTH are TRUE:

(a) AHU Return Air Dew Point greater than 1 degree F ABOVE SWT.

(b) AHU Discharge Air Dew Point greater than 1 degree F ABOVE SWT.

(3) Request Disable: NOT USED.

6. INPUT/OUTPUT SCHEDULE:

a. INPUTS

1) System Requests:

a) Heat Exchanger Dew Point Request

b) Boiler Dehumidification Reheat Request

C. AIR HANDLING UNIT (AHU) WITH HW AND CHW – SINGLE-ZONE VAV (NEW AHU-26 & AHU-27)

1. GENERAL:

a. Refer to AIR HANDLING UNIT – MULTI-ZONE VAV for standard sequence. Below are variances applicable to AHUs serving a single control zone.

b. OCCUPANCY SENSORS: For large spaces, provide enough occupancy sensors for adequate coverage. Coordinate with Electrical.

2. TIME SCHEDULE:

a. Each AHU shall have a dedicated Time Schedule.

b. The Time Schedule shall control all equipment in areas served by AHU, including all Auxiliary Heating Devices, Exhaust Fans, etc.

3. OPERATING MODES:

a. OCCUPIED MODE:

1) OCCUPIED MODE shall be ENABLED when ALL of the following become TRUE

a) Zone Occupancy Sensor signals OCCUPIED for time exceeding ACTIVE Timer.

2) OCCUPIED MODE Override:

a) OCCUPIED MODE shall override STANDBY MODE and UNOCCUPIED MODE.

3) OCCUPIED MODE Timers:

a) ACTIVE Timer: 5 minutes (adjustable).

b) INACTIVE Timer: 15 minutes (adjustable).

c) Timer controlled by DDC Controller, not Occupancy Sensor Settings.

b. STANDBY MODE:

1) STANDBY MODE shall be ENABLED when ALL of the following become TRUE

a) AHU Time Schedule is ON.

b) Zone Occupancy Sensor signals UNOCCUPIED for time exceeding INACTIVE Timer.

c. UNOCCUPIED MODE:

1) UNOCCUPIED MODE shall be ENABLED when ALL of the following become TRUE

a) AHU Time Schedule is OFF.

b) Zone Occupancy Sensor signals UNOCCUPIED for time exceeding INACTIVE Timer.

4. SUPPLY FAN CONTROL:

a. **FAN STATUS:**

1) Provide a VFD Motor Current Value for the Supply Fan. The BAS shall determine Supply Fan Status by comparing the Motor Current to the Fan ON Setpoint.

b. FAN OPERATION:

1) UNOCCUPIED MODE:

a) Supply Fan to cycle ON to maintain Zone Air Temperature (ZAT) Setpoints.

c. **FAN SPEED:**

1) Monitor Supply Airflow. Refer to Section 23 09 00 for Airflow Measuring Device requirements.

2) Modulate the Fan VFD to maintain both of the following:

a) PRIORITY 1: CO_2 Destratification Setpoint. Refer to OA Damper Sequence.
(1) Maximum Fan Speed for CO_2 Destratification: 75 percent (adjustable).
b) PRIORITY 2: ZAT Setpoint.

3) INITIAL START FAN SPEED:
a) OCCUPIED MODE: 75 percent (adjustable).
b) UNOCCUPIED MODE: 50 percent (adjustable).
c) OPTIMAL START MODE: 75 percent (adjustable).

4) SPEED MODULATION TIMER:
a) MINIMUM to MAXIMUM SPEED: 5 minutes (adjustable).
b) MAXIMUM to MINIMUM SPEED: 5 minutes (adjustable).

5. **OUTDOOR AIR DAMPER CONTROL:**

a. DEMAND CONTROL VENTILATION (DCV) – CO_2-BASED:

1) CO_2 Sensors shall be mounted in the Return Air Duct and Outdoor Air Inlet. Refer to Section 23 09 00.

2) The DCV CO_2 Setpoint shall be maintained by the following means:
a) STAGE 1 - Destratification: Reset Supply Air Fan HIGHER. Refer to Supply Fan Sequence.
b) STAGE 2 - OA: Modulate Outdoor Air Damper (OAD) position OPEN.

3) Return Air CO_2 Setpoint:
a) Return Air CO_2 Setpoint ($CO_{2\text{-}RA}$): Shall be the ambient Outdoor Air CO_2 concentration ($CO_{2\text{-}OA}$) level PLUS the Incremental CO_2 Setpoint:
(1) $CO_{2\text{-}RA} = CO_{2\text{-}OA} + CO_{2\text{-}INC.}$
b) Incremental CO_2 Setpoint ($CO_{2\text{-}INC.}$): Shall be determined based on the following schedule.

(1)	CLASSROOMS (AGE 9 PLUS):	625 PPM
(2)	SCIENCE LABS:	490 PPM
(3)	ART CLASSROOMS	440 PPM
(4)	MUSIC CLASSROOMS	860 PPM
(5)	MEDIA CENTERS:	570 PPM
(6)	COMPUTER LABS:	570 PPM
(7)	WOOD/METAL SHOP:	620 PPM
(8)	MULTI-USE ASSEMBLY:	1040 PPM
(9)	DINING/CAFETERIA:	1175 PPM
(10)	CONFERENCE/MEETING:	1355 PPM
(11)	LOBBIES/PREFUNCTION:	1325 PPM
(12)	OFFICE SPACE:	590 PPM
(13)	SALES:	810 PPM

c) Hysteresis: 50 PPM (adjustable).

6. ZONE AIR TEMPERATURE CONTROL:

a. The AHU shall maintain Zone Air Temperature (ZAT) Heating and Cooling Setpoints by the following means:

1) ZAT is above Cooling Setpoint:
a) STAGE 1: Modulate CCV OPEN to maintain DAT.
(1) See DAT Control Sequence.
b) STAGE 2: Modulate SA Fan HIGHER.

2) ZAT is below Heating Setpoint:
a) STAGE 1: Modulate HCV for Finned-Tube Radiation (if present) OPEN.
b) STAGE 2: Modulate HCV for AHU Heating Coil OPEN to maintain DAT.
(1) See DAT Control Sequence.
c) STAGE 3: Modulate SA Fan HIGHER.

3) ZAT is between Cooling Setpoint and Heating Setpoint:
a) STAGE 1: Modulate SA Fan LOWER. Refer to SA Fan Sequence.
b) STAGE 2: Reset DAT per DAT Control Sequence.

b. ZAT SETPOINTS:
    1) COOLING:
        a) OCCUPIED: 76 degrees F (adjustable).
        b) STANDBY: 78 degrees F (adjustable).
        c) UNOCCUPIED: 86 degrees F (adjustable).
    2) HEATING:
        a) OCCUPIED: 68 degrees F (adjustable).
        b) STANDBY: 67 degrees F (adjustable).
        c) UNOCCUPIED: 60 degrees F (adjustable).
    3) HYSTERESIS:
        a) OCCUPIED: 2 degrees F (adjustable).
        b) STANDBY: 2 degrees F (adjustable).
        c) UNOCCUPIED: 5 degrees F (adjustable).

7. DISCHARGE AIR TEMPERATURE CONTROL:

a. GENERAL: Refer to the AIR HANDLING UNIT – MULTI-ZONE VAV DAT Control Sequence for basis of this Sequence.

b. DAT SETPOINTS:
    1) COOLING:
        a) OCCUPIED MODE: 55 degrees F (adjustable).
        b) DEHUMIDIFICATION MODE: Same as OCCUPIED MODE.
        c) ECONOMIZER MODE: Same as OCCUPIED MODE.
        d) UNOCCUPIED MODE: 55 degrees F (adjustable).
        e) OPTIMAL STARTUP MODE: Same as UNOCCUPIED MODE.
    2) HEATING
        a) OCCUPIED MODE: 85 degrees F (adjustable).
        b) DEHUMIDIFICATION MODE: Not applicable to Heating.
        c) ECONOMIZER MODE: Not applicable to Heating.
        d) UNOCCUPIED MODE: 95 degrees F (adjustable).
        e) OPTIMAL STARTUP MODE: Same as UNOCCUPIED MODE.

c. HEATING CONTROL VALVE:
    1) Control Valve shall modulate to maintain DAT Setpoint.
    2) Control Valve shall NOT OPEN if ANY of the following are TRUE:
        a) Cooling Control Valve is OPEN AND DEHUMIDIFICATION MODE is DISABLED.
        b) ECONOMIZER MODE is ENABLED. Refer to ECONOMIZE MODE Sequence.

d. DISCHARGE AIR TEMPERATURE SETPOINT RESET:
    1) When the ZAT is in the Deadband between the ZAT Heating and Cooling Setpoints, the DAT Setpoint shall linearly reset between the Heating and Cooling DAT Setpoints.

8. SYSTEM REQUESTS:

a. REQUESTS FOR BOILER PLANT:
    1) Dehumidification Reheat Request:
        a) Request Initiated when BOTH are TRUE:
            (1) Associated AHU is in DEHUMIDIFICATION MODE.
            (2) HCV opens above 95 percent OPEN.
        b) Request Terminated:
            (1) AHU is NOT in DEHUMIDIFICATION MODE.
        c) Valve Disable: NOT USED.

9. ALARM SCHEDULE:

a. GENERAL: Refer to the AIR HANDLING UNIT – MULTI-ZONE VAV DAT Control Sequence for basis of this Schedule.

b. ZONE AIR TEMPERATURE SENSOR:
    1) HIGH TEMPERATURE ALARM: Temperature above 100 degrees F (adjustable).
    2) LOW TEMPERATURE ALARM: Temperature below 50 degrees F (adjustable).

c. OCCUPANCY SENSOR:

1) SENSOR FEEDBACK ALARM: Zone UNOCCUPIED for 30 days (adjustable).
2) SENSOR FEEDBACK ALARM: Zone OCCUPIED for 24 hours (adjustable).

d. CONTROL VALVES:
1) HEATING VALVE FEEDBACK ALARM (FTR): Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.

10. **INPUT/OUTPUT SCHEDULE**

a. GENERAL: Refer to the AIR HANDLING UNIT – MULTI-ZONE VAV DAT Control Sequence for basis of this Schedule.

b. INPUTS
1) Zone Requests:
a) Boiler Dehumidification Reheat Request
2) Zone Air Temperature
3) Occupancy Sensor (multiple, if applicable).

c. OUTPUTS
1) Heating Control Valve (FTR)

3.5 TERMINAL AIR SYSTEMS

A. AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH HW REHEAT

1. GENERAL:

a. OCCUPANCY SENSORS: For large spaces, provide enough occupancy sensors for adequate coverage. Coordinate with Electrical.

2. TIME SCHEDULE:

a. Each VAV box shall utilize the Time Schedule of its associated AHU.

3. OPERATING MODES:

a. OCCUPIED MODE:
1) OCCUPIED MODE shall be ENABLED when ALL of the following become TRUE
a) Associated AHU Time Schedule is ON or OFF.
b) Zone Occupancy Sensor signals OCCUPIED for time exceeding ACTIVE Timer.
2) OCCUPIED MODE shall override STANDBY MODE.
3) OCCUPIED MODE Timers:
a) ACTIVE Timer: 2 minutes (adjustable).
b) INACTIVE Timer: 15 minutes (adjustable).
c) Timer controlled by DDC Controller, not Occupancy Sensor Settings.

b. STANDBY MODE:
1) STANDBY MODE shall be ENABLED when ALL of the following become TRUE
a) Associated AHU Time Schedule is ON.
b) Zone Occupancy Sensor signals UNOCCUPIED for time exceeding INACTIVE Timer.

c. UNOCCUPIED MODE:
1) UNOCCUPIED MODE shall be ENABLED when ALL of the following become TRUE
a) Associated AHU Time Schedule is OFF.
b) Zone Occupancy Sensor signals UNOCCUPIED for time exceeding INACTIVE Timer.

4. ZONE TEMPERATURE CONTROL:

a. The VAV box shall maintain Zone Air Temperature (ZAT) Heating and Cooling Setpoints by the following means:
1) ZAT is above Cooling Setpoint:
a) STAGE 1: Modulate VAV damper OPEN to MAXIMUM COOLING position.
2) ZAT is below Heating Setpoint:
a) STAGE 1: Modulate HCV for Finned-Tube Radiation (if present) OPEN.
b) STAGE 2: Modulate HCV for VAV Reheat Coil OPEN.
c) STAGE 3: Modulate VAV damper OPEN to MAXIMUM HEATING position.
3) ZAT is between Cooling Setpoint and Heating Setpoint:

a) VAV damper is at MINIMUM position.
b) HCV for VAV Reheat Coil is CLOSED.
c) HCV for Finned-Tube Radiation (if present) is CLOSED.

b. ZAT SETPOINTS:
1) COOLING:
a) OCCUPIED: 76 degrees F (adjustable).
b) STANDBY: 78 degrees F (adjustable).
c) UNOCCUPIED: 86 degrees F (adjustable).
2) HEATING:
a) OCCUPIED: 68 degrees F (adjustable).
b) STANDBY: 67 degrees F (adjustable).
c) UNOCCUPIED: 60 degrees F (adjustable).
3) HYSTERESIS:
a) OCCUPIED: 2 degrees F (adjustable).
b) STANDBY: 2 degrees F (adjustable).
c) UNOCCUPIED: 10 degrees F (adjustable).

c. DAMPER POSITION SETPOINTS:
1) MAXIMUM COOLING:
a) OCCUPIED: Refer to Drawing Schedules.
b) STANDBY: OCCUPIED MAXIMUM COOLING value (adjustable).
c) UNOCCUPIED: OCCUPIED MAXIMUM COOLING value (adjustable).
2) MAXIMUM HEATING:
a) OCCUPIED: Refer to Drawing Schedules.
b) STANDBY: OCCUPIED MINIMUM value (adjustable).
c) UNOCCUPIED: OCCUPIED MINIMUM value (adjustable).
3) MINIMUM:
a) OCCUPIED: Refer to Drawing Schedules.
(1) Note that this value shall not be less that the code minimum ventilation airflow requirement.
b) STANDBY: Fully CLOSED (adjustable).
c) UNOCCUPIED: Fully CLOSED.

5. ZONE REQUESTS:

a. AHU REQUESTS:
1) REQUESTS FOR DAT RESET:
a) Zone Cooling Request:
(1) Request Activated: VAV Damper Position opens above 95 percent OPEN.
(2) Request Deactivated: VAV Damper Position closes below 85 percent OPEN.
(3) Zone Disable: Provide a binary data enable point for each VAV Damper to ENABLE/DISABLE Cooling Requests.
(a) Eliminate Nuisance Alarms when Damper is DISABLED.
b) Zone Heating Request:
(1) Request Activated: VAV Reheat Coil Control Valve (RCCV) opens above 10 percent OPEN.
(2) Request Deactivated: VAV RCCV is fully CLOSED.
(3) Zone Disable: Provide a binary data enable point for each VAV RCCV to ENABLE/DISABLE Heating Requests.
(a) Eliminate Nuisance Alarms when Damper is DISABLED.
2) REQUESTS FOR SUPPLY FAN CYCLING:
a) Unoccupied Zone Cooling Request:
(1) Request Activated: VAV Damper Position opens above 95 percent OPEN.
(2) Request Deactivated: VAV Damper Position closes below 85 percent OPEN.

(3) Zone Disable: Provide a binary data enable point for each VAV Damper to ENABLE/DISABLE Cooling Requests.
(a) Eliminate Nuisance Alarms when Damper is DISABLED.

b) Unoccupied Zone Heating Request:
(1) Request Activated: VAV Reheat Coil Control Valve (RCCV) opens above 10 percent OPEN.
(2) Request Deactivated: VAV RCCV is fully CLOSED.
(3) Zone Disable: Provide a binary data enable point for each VAV RCCV to ENABLE/DISABLE Heating Requests.
(a) Eliminate Nuisance Alarms when Damper is DISABLED.

3) REQUESTS FOR SUPPLY FAN SPEED RESET:
a) Zone Pressure Request:
(1) Request Activated: VAV damper opens above 95 percent OPEN.
(2) Request Deactivated: VAV damper closes below 80 percent OPEN.
(3) Zone Disable: Provide a binary data enable point for each VAV Damper to enable/disable Pressure Requests.
(a) Eliminate Nuisance Alarms when Damper is DISABLED.

b. REQUESTS FOR BOILER PLANT:
1) Dehumidification Reheat Request:
a) Request Initiated when BOTH are TRUE:
(1) Associated AHU is in DEHUMIDIFICATION MODE.
(2) HCV opens above 95 percent OPEN.
b) Request Terminated:
(1) AHU is NOT in DEHUMIDIFICATION MODE.
c) Valve Disable: NOT USED.

c. HOT WATER LOOP REQUESTS:
1) Control Valve Pressure Request:
a) Request Initiated: Control Valve opens above 90 percent OPEN.
b) Request Terminated: Control Valve closes below 80 percent OPEN.
c) Valve Disable: Provide a binary data enable point for each Valve to enable/disable the Control Valve in the algorithm.
(1) Eliminate Nuisance Alarms when Valve is DISABLED.

6. ALARM SCHEDULE:

a. NUISANCE ALARMS: Time Delays and Setpoints shall be adjusted to eliminate Nuisance Alarms.

b. ZONE AIR TEMPERATURE SENSOR:
1) HIGH TEMPERATURE ALARM: Temperature above 100 degrees F (adjustable).
2) LOW TEMPERATURE ALARM: Temperature below 50 degrees F (adjustable).

c. OCCUPANCY SENSOR:
1) SENSOR FEEDBACK ALARM: Zone UNOCCUPIED for 30 days (adjustable).
2) SENSOR FEEDBACK ALARM: Zone OCCUPIED for 24 hours (adjustable).

d. CONTROL VALVES:
1) HEATING VALVE FEEDBACK ALARM: Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.
2) HEATING VALVE FEEDBACK ALARM (FTR): Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.

e. DAMPERS:
1) VAV DAMPER FEEDBACK ALARM: Damper Commanded to Position, Damper Position Status deviates from Setpoint by 10 percent (adjustable) after delay.

7. INPUT/OUTPUT SCHEDULE

a. INPUTS
1) Operating Mode (Occupied, Standby, Unoccupied)
2) Zone Requests:

a) AHU DAT Zone Cool Request
b) AHU DAT Zone Heat Request
c) AHU Fan Unoccupied Cool Request
d) AHU Fan Unoccupied Heat Request
e) AHU Fan Zone Pressure Request.
f) Boiler Dehumidification Reheat Request
g) HW Loop CV Pressure Request

3) Zone Air Temperature
4) Occupancy Sensor (multiple, if applicable).
5) Reheat Coil Discharge Air Temperature
6) Supply Airflow CFM

b. OUTPUTS
1) Heating Control Valve
2) Heating Control Valve (FTR)
3) Air Damper

B. AIR TERMINAL UNITS – INDUCTION DISPLACEMENT UNITS (IDU) WITH HW AND CHW

1. GENERAL:

a. Refer to AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH REHEAT for standard sequence. Below are variances applicable to Induction Displacement Units (IDU).

2. OPERATING MODES:

a. Refer to AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH REHEAT for OCCUPIED MODE and UNOCCUPIED MODE.

b. DEHUMIDIFICATION MODE:
1) DEHUMIDIFICATION MODE shall be ENABLED when the associated AHU ENABLES DEHUMIDIFICATION MODE.
2) DEHUMIDIFICATION MODE Override:
a) DEHUMIDIFICATION MODE shall override all other operating modes, including OCCUPIED MODE.

3. ZONE TEMPERATURE CONTROL:

a. The IDU shall maintain Zone

b. Zone Air Temperature (ZAT) Heating and Cooling Setpoints and IDU Discharge Air Temperature (DAT) Setpoint (when occupied) by the following means:
1) ZAT is above Cooling Setpoint:
a) STAGE 1: OPEN Primary Air Valve (if CLOSED).
b) STAGE 2: Modulate CCV of IDU OPEN.
2) ZAT is below Heating Setpoint:
a) STAGE 1: Modulate HCV for Finned-Tube Radiation (if present) OPEN to maintain ZAT.
b) STAGE 2: Modulate HCV for IDU Heating Coil(s) (if present) OPEN to maintain ZAT.
c) STAGE 3: OPEN Primary Air Valve (if CLOSED).
3) ZAT is between Cooling Setpoint and Heating Setpoint:
a) Modulate HCV for IDU Heating Coil (if present) OPEN to maintain unit DAT Setpoint.
b) CCV for IDU is CLOSED.
c) HCV for Finned-Tube Radiation (if present) is CLOSED.

c. ZAT SETPOINTS:
1) COOLING:
a) OCCUPIED: 78 degrees F (adjustable).
b) STANDBY: 80 degrees F (adjustable).
c) UNOCCUPIED: 86 degrees F (adjustable).
d) DEHUMIDIFICATION: Same as previous Mode overridden.

2) HEATING:
a) OCCUPIED: 68 degrees F (adjustable).
b) STANDBY: 67 degrees F (adjustable).
c) UNOCCUPIED: 60 degrees F (adjustable).
d) DEHUMIDIFICATION: Same as previous Mode overridden.
3) HYSTERESIS:
a) OCCUPIED: 2 degrees F (adjustable).
b) STANDBY: 2 degrees F (adjustable).
c) UNOCCUPIED: 10 degrees F (adjustable).
d) DEHUMIDIFICATION: Same as previous Mode overridden.

d. DAT SETPOINT:
1) OCCUPIED: 5 degrees F below Heating ZAT Setpoint (adjustable).
2) STANDBY: Not Controlled.
3) UNOCCUPIED: Not Controlled.
4) DEHUMIDIFICATION: Same as previous Mode overridden.

4. PRIMARY AIR VALVE

a. POSITION CONTROL:
1) Air Valve to be OPEN when ANY of the following are TRUE:
a) IDU is in OCCUPIED MODE.
b) IDU is in DEHUMIDIFICATION MODE
c) Associated AHU is in OPTIMAL STARTUP
d) Zone Temperature Control sequence is above or below setpoint and Air Valve is requested OPEN. Refer to Zone Temperature Control sequence.
2) Air Valve to be CLOSED when ALL of the following are TRUE:
a) IDU is in UNOCCUPIED MODE OR STANDBY MODE
b) Zone Temperature Control sequence is NOT requesting Air Valve OPEN. Refer to Zone Temperature Control sequence.

b. POSITION SETPOINTS:
1) COOLING:
a) OCCUPIED: Fully OPEN.
b) STANDBY: Fully CLOSED.
c) UNOCCUPIED: Fully CLOSED.
d) DEHUMIDIFICATION: Fully OPEN.
e) OPTIMAL START UP: Fully OPEN.
2) HEATING:
a) OCCUPIED: Fully OPEN.
b) STANDBY: Fully CLOSED.
c) UNOCCUPIED: Fully CLOSED.
d) DEHUMIDIFICATION: Fully OPEN.
e) OPTIMAL START UP: Fully OPEN.

5. ZONE REQUESTS:

a. HIGH-TEMPERATURE CHILLED WATER LOOP REQUESTS:
1) Control Valve Pressure Request:
a) Request Initiated: Control Valve opens above 90 percent OPEN.
b) Request Terminated: Control Valve closes below 80 percent OPEN.
c) Valve Disable: Provide a binary data enable point for each Valve to enable/disable the Control Valve in the algorithm.
(1) Eliminate Nuisance Alarms when Valve is DISABLED.

6. ALARM SCHEDULE:

a. CONTROL VALVES:
1) HEATING VALVE FEEDBACK ALARM: Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.

2) HEATING VALVE FEEDBACK ALARM (FTR): Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.
3) COOLING VALVE FEEDBACK ALARM: Valve Commanded to Position, Valve Position Status deviates from Setpoint by 10 percent (adjustable) after delay.

b. DAMPERS:
1) PRIMARY AIR VALVE FEEDBACK ALARM: Damper Commanded to Position, Damper Position Status deviates from Setpoint by 10 percent (adjustable) after delay.

c. Refer to AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH REHEAT Sequence for additional Alarms.

7. INPUT/OUTPUT SCHEDULE:

a. The following Inputs and Outputs are to be used in lieu of the AIR TERMINAL UNITS – SINGLE-DUCT VAV BOXES WITH REHEAT Input/Output Schedule.

b. INPUTS
1) Operating Mode (Occupied, Standby, Unoccupied)
2) Zone Requests:
a) AHU DAT Zone Cool Request
b) AHU DAT Zone Heat Request
c) AHU Fan Unoccupied Cool Request
d) AHU Fan Unoccupied Heat Request
e) AHU Fan Zone Pressure Request.
f) Boiler Dehumidification Reheat Request
g) HW Loop CV Pressure Request
3) Zone Air Temperature
4) Occupancy Sensor (multiple, if applicable).
5) Reheat Coil Discharge Air Temperature
6) Supply Airflow CFM

c. OUTPUTS
1) Heating Control Valve
2) Heating Control Valve (FTR)
3) Air Damper

C. AIR TERMINAL UNITS – ACTIVE CHILLED BEAMS (ACB) WITH HW AND CHW

1. GENERAL:

a. Refer to AIR TERMINAL UNITS – INDUCTION DISPLACEMENT UNITS (IDU) for standard sequence. Below are variances applicable to Active Chilled Beams (ACB).

2. ZONE TEMPERATURE CONTROL:

a. The ACB shall maintain Zone Air Temperature (ZAT) Heating and Cooling Setpoints by the following means:
1) ZAT is above Cooling Setpoint:
a) STAGE 1: OPEN Primary Air Valve (if CLOSED).
b) STAGE 2: Modulate CCV of ACB OPEN.
2) ZAT is below Heating Setpoint:
a) STAGE 1: Modulate HCV for Finned-Tube Radiation (if present) OPEN to maintain ZAT.
b) STAGE 2: Modulate HCV for ACB Heating Coil(s) (if present) OPEN to maintain ZAT.
c) STAGE3: OPEN Primary Air Valve (if CLOSED).
3) ZAT is between Cooling Setpoint and Heating Setpoint:
a) CCV for ACB is CLOSED.
b) HCV for ACB is CLOSED.
c) HCV for Finned-Tube Radiation (if present) is CLOSED.

b. ZAT SETPOINTS:
1) COOLING:

a) OCCUPIED: 78 degrees F (adjustable).
b) STANDBY: 80 degrees F (adjustable).
c) UNOCCUPIED: 86 degrees F (adjustable).
d) DEHUMIDIFICATION: Same as previous Mode overridden.

2) HEATING:
a) OCCUPIED: 68 degrees F (adjustable).
b) STANDBY: 67 degrees F (adjustable).
c) UNOCCUPIED: 60 degrees F (adjustable).
d) DEHUMIDIFICATION: Same as previous Mode overridden.

3) HYSTERESIS:
a) OCCUPIED: 2 degrees F (adjustable).
b) STANDBY: 2 degrees F (adjustable).
c) UNOCCUPIED: 5 degrees F (adjustable).
d) DEHUMIDIFICATION: Same as previous Mode overridden.

D. EXHAUST FANS

1. **TIME SCHEDULE:**
a. Each Exhaust Fan shall utilize the Time Schedule of the associated AHU serving that area.

2. TOILET EXHAUST FANS WITH OCCUPANCY OR VACANCY SENSOR:
a. EXHAUST FANS ON:
1) Fans shall only run when the following are ALL TRUE:
a) Associated AHU Time Schedule is ON.
b) As Occupancy/Vacancy Sensor is OCCUPIED.
b. EXHAUST FAN OFF:
1) Fans shall NOT run when ANY of the follower are TRUE:
a) Associated AHU Time Schedule is OFF.
b) Occupancy/Vacancy Sensor in UNOCCUPIED.

3. KILN EXHAUST FAN
a. Kile Exhaust Hood/Fan provided with stand-alone 7-day programmable controller.

4. KITCHEN EXHAUST FAN SERVING TYPE I HOOD (GREASE)
a. By Food Service Consultant and Ventilation Controller.

5. KITCHEN EXHAUST FAN SERVING TYPE II HOOD (MOISTURE)
a. By Food Service Consultant.

6. OTHER EXHAUST FANS:
a. EXHAUST FANS ON:
1) Fans shall only run when the following are ALL TRUE:
a) Associated AHU Time Schedule is ON.
b) Associated AHU is in OCCUPIED mode.
b. EXHAUST FANS OFF:
1) Fans shall NOT run when ANY of the follower are TRUE:
a) Associated AHU Time Schedule is OFF.
b) Associated AHU is in STANDBY, UNOCCUPIED, or OPTIMAL START modes.

7. FAN STATUS:
a. Monitor the status of ALL Exhaust Fans.
b. EXHAUST FAN AIRFLOW VALUE:
1) For each AHU, the active Exhaust Fan Airflow value shall be calculated based on the Fan Status of each Exhaust Fan associated with the AHU and the Design Exhaust Airflow from the Drawings.
2) Refer to AHU Sequence.

8. INPUT/OUTPUT SCHEDULE
a. INPUTS
1) Fan Command
b. OUTPUTS

1) Fan Status
2) Occupancy/Vacancy Sensor Status (as applicable)

c. ALARMS
1) Fan Commanded ON, Fan Status OFF
2) Fan Commanded OFF, Fan Status ON
3) Occupancy/Vacancy Sensor Status OCCUPIED over 24 Hours.

E. DESTRATIFICATION FANS

1. **TIME SCHEDULE:**
a. Each Destratification Fan shall utilize the Time Schedule of the associated AHU serving that area.

2. FAN OPERATION:
a. Destratification Fans is ON when
1) AHU Time Schedule is ON.
b. Destratification Fans is OFF when
1) AHU Time Schedule is OFF.

F. UNIT HEATERS & CABINET UNIT HEATERS WITH HW

1. **TIME SCHEDULE:**
a. Each (Cabinet) Unit Heater shall ALWAYS be scheduled ON.

2. ZONE TEMPERATURE CONTROL:
a. The unit shall maintain Zone Air Temperature (ZAT) Heating Setpoints by the following means:
1) ZAT is below Heating Setpoint:
a) Fan Cycles ON
b) HCV OPENS 100 percent.
b. ZAT SETPOINTS:
1) HEATING: 65degrees F (adjustable).
2) HYSTERESIS: 5 degrees F (adjustable).

3. ZONE REQUEST:
a. HOT WATER LOOP REQUESTS:
1) Control Valve Pressure Request:
a) Request Initiated: Control Valve opens above 95 percent OPEN.
b) Request Terminated: Control Valve closes below 80 percent OPEN.
c) Valve Disable: Provide a binary data enable point for each Valve to enable/disable the Control Valve in the algorithm.

4. INPUT/OUTPUT SCHEDULE
a. Inputs
1) Zone Temperature
b. Outputs
1) Hot Water Valve/Fan Relay

G. CABINET UNIT HEATER (HOT WATER / CHILLED WATER FAN COIL – VESTIBULE)

1. TIME SCHEDULE:
a. Each Cabinet Unit Heater shall ALWAYS be scheduled ON.

2. ZONE TEMPERATURE CONTROL:
a. The unit shall maintain Zone Air Temperature (ZAT) Heating and Cooling Setpoints by the following means:
1) HEATING MODE: ZAT is below Heating Setpoint:
a) Fan operates at LOW speed (continuous or cycling as noted below).
b) Hot Water Control Valve (HCV) modulates from 0–100% to maintain setpoint.
c) Fan may increase to MEDIUM speed if ZAT falls more than 3°F below setpoint (adjustable).
2) COOLING MODE: ZAT is above Cooling Setpoint:

a) Fan operates at LOW speed.
b) Chilled Water Control Valve (CCV) modulates from 0–100% to maintain setpoint.
c) Fan may increase to MEDIUM speed if ZAT rises more than 3°F above setpoint (adjustable).

3) DEADBAND (NO HEATING OR COOLING): ZAT is between Heating and Cooling Setpoints:
a) All control valves CLOSED.
b) Fan operates at LOW speed continuously for air circulation and vestibule temperature averaging (adjustable to cycle OFF if required for acoustics).
(1) Fan shall cycle off after 5 minutes if still in deadband.

4) ZAT SETPOINTS:
a) HEATING: 65°F (adjustable).
b) COOLING: 75°F (adjustable).
c) DEADBAND: 5°F minimum (adjustable).
d) HYSTERESIS: 2°F (adjustable).

3. VESTIBULE OPERATION / SPECIAL CONTROL:

a. Unit shall be optimized for high-visibility architectural application:
1) Fan speed changes shall be minimized to reduce audible and visual disturbance.
2) Valve modulation shall be smooth (no step control).

4. ZONE REQUEST:

a. HOT WATER LOOP REQUESTS:
1) Control Valve Pressure Request:
a) Request Initiated: HCV opens above 95% OPEN.
b) Request Terminated: HCV closes below 80% OPEN.
c) Valve Enable: Provide binary enable point.

b. CHILLED WATER LOOP REQUESTS:
1) Control Valve Pressure Request:
a) Request Initiated: CCV opens above 95% OPEN.
b) Request Terminated: CCV closes below 80% OPEN.
c) Valve Enable: Provide binary enable point.

5. FREEZE PROTECTION:

a. If ZAT < 40°F (adjustable):
1) Fan ON (LOW speed minimum).
2) HCV commanded to 100% OPEN.
3) CCV commanded CLOSED.
4) Generate BAS alarm.

6. CONDENSATION CONTROL (COOLING MODE):

a. If unit is equipped with condensate pan and sensor:
1) Upon high condensate level:
a) CCV CLOSED.
b) Fan OFF after time delay.
c) Generate BAS alarm.

7. INPUT/OUTPUT SCHEDULE:

a. Inputs:
1) Zone Temperature
2) Condensate Overflow Switch

b. Outputs:
1) Hot Water Control Valve (modulating)
2) Chilled Water Control Valve (modulating)
3) Fan Speed Command (Low/Medium or ECM signal)

3.6 MISCELLANEOUS SYSTEMS

A. DOMESTIC HOT WATER

1. HOT WATER RECIRCULATION PUMP:

a. TIME SCHEDULE:

1) All Recirculation Pumps shall utilize a Time Schedule.

b. FAN OPERATION:

1) Recirculation Pumps is ON when

a) Time Schedule is ON.

2) Recirculation Pumps is OFF when

a) Time Schedule is OFF.

B. EXTERIOR LIGHTING

1. Exterior lighting shall turn on when schedule is on and the exterior light photocell is below the light level setpoint. Coordinate with Division 26.
2. Exterior lighting shall turn off when schedule is OFF. Coordinate with Division 26.

C. UTILITY METERING

1. Monitor and totalize monthly the fuel consumption [therms].
2. Monitor and totalize monthly the electric consumption [kwh].
   a. Provide instantaneous demand [kw].
3. Trend electrical and fuel consumption. Trend instantaneous demand.

END OF SECTION

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SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Natural gas piping buried within 5 feet of building.
2. Natural gas piping above grade.
3. Unions and flanges.
4. Valves.
5. Pipe hangers and supports.
6. Strainers.
7. Natural gas pressure regulators.
8. Natural gas pressure relief valves.
9. Underground pipe markers.
10. Bedding and cover materials.

B. Related Sections:
1. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Piping materials for gas piping systems.
2. Section 23 05 23 - General-Duty Valves for HVAC Piping: Valves for gas piping systems.
3. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports [and firestopping] for placement by this section.
4. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for valve and pipe identification for placement by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 175 psi (Sizes NPS 1/2 through NPS 2).
4. ASME B31.1 – Power Piping.
5. ASME B31.9 - Building Services Piping.
6. ASME BPVC Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
5. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
6. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
7. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:
1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

E. American Water Works Association:

1. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacturer, Selection, Application, and Installation.
2. MSS SP-67 - Butterfly Valves.
3. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
4. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

G. Minnesota Department of Labor & Industry:
1. Minnesota Mechanical and Fuel Gas Code.

H. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.

I. Underwriters Laboratories Inc.:
1. UL 842 - Standard for Valves for Flammable Fluids.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

B. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

C. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

D. Provide pipe hangers and supports in accordance with MSS SP-58.

E. Use plug or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 SUBMITTALS

A. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:
a. Strainers.
b. Natural gas pressure regulators.
c. Natural gas pressure relief valves.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves, piping system, and system components.

B. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions and spare parts lists.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform natural gas Work in accordance with NFPA 54.

C. Perform work in accordance with local gas company requirements.

D. Perform Work in accordance with ASME B31.1 and ASME B31.9 code for installation of piping systems and ASME Section BPVC IX for welding materials and procedures.

E. Perform Work in accordance with AWS D1.1/D1.1M for welding hanger and support attachments to building structure.

F. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate trenching, excavating, bedding, and backfilling of buried piping systems with General Contractor.

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 galvanized.
   1. Fittings: ASTM A234/A234M forged steel welding type, galvanized.
   2. Joints: ASME B31.9, welded.
   3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

B. Polyethylene Pipe (PE): ASTM D2513
   1. Labeling: Marked “Gas” and “ASTM D2513”
   2. Fittings: Polyethylene, ASTM D2513.
   3. Joints: Compression-type mechanical joints with internal tubular rigid stiffener.

C. Copper Tubing: ASTM B88, Type K or L, annealed.
   1. Fittings: ASME B16.26 cast bronze.
   2. Joints: Brazed.

2.2 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
   2. Joints:
      a. Pipe 2 inches and smaller: Threaded.
      b. Pipe 2-1/2 inches and larger: Welded.
   3. Outdoor and High-Humidity Applications: Pipe and fittings to be galvanized.

B. Copper Tubing: ASTM B88, Type K or L, annealed.
   1. Fittings: ASME B16.26 cast bronze.
      a. Option: Compression type.

2. Joints: Brazed.
    a. Option: Flared (compression type).

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.4 BALL VALVES

A. Manufacturers:
1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc..
5. Stockham Valves & Fittings.

B. [NGV-1] 1/4 inch to 1 inch: MSS SP-110, Class 125, two-piece, threaded ends, bronze body, chrome plated bronze ball, reinforced Teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.

2.5 PLUG VALVES

A. Manufacturers:
1. DeZURIK, Unit of SPX Corp..
2. Flow Control Equipment, Inc..
3. Homestead Valve.

B. [NGV-2] 2-1/2 inches and Larger: MSS SP-78, Class 150, round port, full pipe area, pressure lubricated, Teflon packing, flanged ends.

2.6 PIPE HANGERS AND SUPPORTS

A. Refer to Section 23 05 29.

2.7 STRAINERS

A. Manufacturers:
1. Mueller Steam Specialty.
2. O.C. Keckley Company.
3. Spirax Sarco, Inc..

B. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.8 NATURAL GAS PRESSURE REGULATORS

A. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.

1. Temperatures: minus 20 degrees F to 150 degrees F.
2. Body: Cast iron.
3. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.
4. Disk, diaphragm, and O-ring: Nitrile.
5. Maximum inlet pressure: 150 psig.
6. Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.

2.9 NATURAL GAS CONTROL SYSTEM

A. Manufacturer:
   1. ASCO.

B. Serves: Science classroom gas service.

C. Relay Control Panel:
   1. 120 volts AC output, Key-operated switch, manual “on” and “off” buttons.

D. Master Control Station:
   1. Key-operated, normally open switch and a normally closed pushbutton, flush mounted.
   2. Inscribed with “Gas Valve Control” at top of faceplate with “Open” over switch and “Shut” over button.

E. Control Station:
   1. Momentary mushroom pushbutton labeled “Emergency Stop”. Power to valves is shut-off and closed in less than 0.1 seconds.

F. Solenoid Valves:
   1. 2-way normally closed operation for gas service, explosion-proof, 120 volts AC, rated for building gas pressure.

G. Refer to Drawings for equipment locations.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install pipe hangers and supports in accordance with Section 23 05 29.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. All pipe sizing on Drawings is using steel pipe. Pipe sizing to be verify by Contractor if non-steel pipe is used.

B. Install natural gas piping in accordance with NFPA 54.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.

1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.

H. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.

L. Provide support for utility meters in accordance with requirements of utility company.

M. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood. Do not install within 10 feet of fresh air intakes.

N. Install valves with stems upright or horizontal, not inverted.

O. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

P. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.

3.4 FIELD QUALITY CONTROL

A. Inspect, test and purge gas piping in accordance with Minnesota Mechanical and Fuel Gas Code and local gas utility company requirements.

B. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

END OF SECTION

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Heating water piping, above ground.
2. Chilled water piping, buried.
3. Chilled water piping, above ground.
4. Equipment drains and over flows.
5. Unions and flanges.
6. Pipe hangers and supports.
7. Valves.

B. Related Sections:
1. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Product and execution requirements for expansion compensation devices use in heating and cooling piping systems.
2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports, sleeves, [and firestopping] for placement by this section.
3. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolation for placement by this section.
4. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
5. Section 23 07 00 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.
6. Section 23 21 16 - Hydronic Piping Specialties: Product and execution requirements for piping specialties used in heating and cooling piping systems.
7. Section 23 21 23 - Hydronic Pumps: Product and execution requirements for pumps used in heating and cooling piping systems.
8. Section 23 25 00 - HVAC Water Treatment: Product and execution requirements for cleaning and chemical treatment of heating and cooling piping systems.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
3. ASME B31.1 - Power Piping.
4. ASME B31.9 - Building Services Piping.
5. ASME BPVC Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM A536 - Standard Specification for Ductile Iron Castings.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
9. ASTM F2389 – Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.

C. American Welding Society:
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-67 - Butterfly Valves.
   2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

B. Pipe sizes indicated on drawings are based on ASTM B88 Type L copper tubing and ASTM A53/A53M, Schedule 40 steel pipe. For non-metallic pipe, contractor to verify nominal pipe size for equivalent pressure drop, flow rate, and velocity.

C. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections whenever joining dissimilar metals in open systems.

D. Provide flanges, union, and couplings at locations requiring servicing. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

E. Provide pipe hangers and supports in accordance with MSS SP-69.

F. Use ball or butterfly valves, as indicated on Drawings, for shut-off and to isolate equipment, part of systems, or vertical risers.

G. Use globe, ball, or butterfly valves, as indicated on Drawings, for throttling, bypass, or manual flow control services.

H. Use spring loaded check valves on discharge of hydronic pumps.

I. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

J. Flexible Connectors: Use at or near pumps, compressors, and other motor driven equipment where piping configuration does not absorb vibration. The coupling shall be placed in close proximity to the source of the vibration.

1.4 SUBMITTALS

A. Product Data – Polypropylene-Random Piping:
   1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Hangers and Supports: Submit manufacturers catalog information including load capacity.

B. Welders' Certificate: Include welders' certification of compliance with ASME BPVC Section IX, AWS D1.1/D1.1M, or equivalent.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves, equipment and accessories.

B. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

C. Pressure Test Report: Submit verification of pressure test report. Include test type, testing pressure, and length of time.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME BPVC Section IX for welding materials and procedures.

C. Perform Work in accordance with AWS D1.1/D1.1M for welding hanger and support attachments to building structure.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. All casings used for coupling housing, fittings, valve bodies, and specialties shall be date-stamped for quality assurance and traceability.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience .

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate location of Additions and Remodel phase piping connections to EMT Lab phase piping (shown as existing on Drawings). Coordinate with EMT Lab Contractor.

B. Coordinate trenching, excavating, bedding, and backfilling of buried piping systems with General Contractor.

PART 2 PRODUCTS

2.1 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, cut or rolled grooved ends.
   1. Fittings: ASTM A395/A395M and ASTM A536 ductile iron, or ASTM A234/A234M carbon steel, grooved ends.
      a. Where cast or wrought pattern is not available, factory-fabricated fittings from ASTM A53/A53M steel pipe may be used. Fittings shall be factory grooved and tested.
      b. Victaulic No. V10, or equal: 90-degree elbow.
      c. Victaulic No. V11, or equal: 45-degree elbow.
      d. Victaulic No. V20, or equal: Straight tee.

2. Victaulic Installation-Ready fittings for Schedule 10 through Schedule 80 plain end carbon steel piping in HVAC and mechanical applications, sizes NPS ½" through 2". System rated for a working pressure of 300 psi. Fittings shall consist of a ductile iron housing conforming to ASTM A536, Grade 65-45-12, with Installation-Ready ends orange enamel coated or zinc coated (for pool areas and all outdoor sections). Fittings shall be provided complete with gasket liner, zinc-electroplated steel bolts and nuts as per the mechanical properties of ASTM A449, and 300 series stainless steel retainer. Basis of Design: Victaulic QuickVic SD.
3. Joints: Grooved mechanical couplings.
4. Joints: Push-fit complying with NSF 61 and ASSE 1061. Crimping tool approved by Manufacturer and local Authority Having Jurisdiction. For pipe sizes 3/8 to 2 inches only.

B. Copper Tubing: ASTM B88, Type L, hard drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.2 CHILLED WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53/A53M Schedule 40, black, cut or rolled grooved ends.
1. Fittings: ASTM A395/A395M and ASTM A536 ductile iron, or ASTM A234/A234M carbon steel, grooved ends.
a. Victaulic No. V10, or equal: 90-degree elbow.
b. Victaulic No. V11, or equal: 45-degree elbow.
c. Victaulic No. V20, or equal: Straight tee.
2. Victaulic Installation-Ready fittings for Schedule 10 through Schedule 80 plain end carbon steel piping in HVAC and mechanical applications, sizes NPS ½" through 2". System rated for a working pressure of 300 psi. Fittings shall consist of a ductile iron housing conforming to ASTM A536, Grade 65-45-12, with Installation-Ready ends orange enamel coated or zinc coated (for pool areas and all outdoor sections). Fittings shall be provided complete with gasket liner, zinc-electroplated steel bolts and nuts as per the mechanical properties of ASTM A449, and 300 series stainless steel retainer. Basis of Design: Victaulic QuickVic SD.
3. Joints: Grooved mechanical couplings.

B. Copper Tubing: ASTM B88, Type L, hard drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered.
3. Dielectric Connections: Dielectric union connections are NOT permitted.
4. PVC Piping: PVC.
5. CPVC Piping: CPVC.
6. PP-R Piping: PP-R

B. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.
3. PVC Piping: PVC flanges.
4. CPVC Piping: CPVC flanges.
5. PP-R Piping: PP-R flanges.
6. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

D. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

2.4 DIELECTRIC FITTINGS:

A. Dielectric Waterway Connectors:
   1. Manufacturers:
      a. ClearFlow (Elstel Perfection).
      b. Victaulic.
   2. Dissimilar metals shall be separated with a dielectric waterway connector.
   3. Material: Electro-zinc-plated steel casing, insert plastic lining, threaded ends.

B. Dielectric Waterway: Fittings shall be a copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service. Fittings shall have threaded ends, grooved ends, or a combination. Basis of Design: Victaulic Style 647.

2.5 MECHANICAL GROOVED COUPLINGS

A. Manufacturers:
   1. Victaulic.
   2. Anvil Gruvlock.
   3. Grinnell.

B. Ferrous piping, 2 through 12 inches:
   1. Rigid Type: QuickVic couplings for pipe prepared with the Victaulic Original Grooved System (OGS) groove profile, sizes 2” through 12”, consisting of two ductile iron housing segments conforming to ASTM A536 Grade 65-45-12, orange coated or hot dipped galvanized as per ASTM A123, center-leg gasket, and ASTM A449 and A563 compliant zinc-electroplated carbon steel or ASTM F593 and F594 compliant stainless steel (with galling reducing coating) bolts and nuts. Installation-Ready, for direct stab installation without field disassembly. Suitable for a minimum working pressure of 400 psi with standard weight pipe.
      a. Housings cast with torque-absorber and shift-limiting slant bolt pad design to provide piping system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9, and to prevent mis-assembly due to overshift. Basis of Design: Victaulic Installation-Ready Style 107V, or equal.
      b. Housings cast with alignment indicator notch for visual proper alignment to adjoining fitting.
      c. Gaskets shall be verified as suitable for the intended service, Grade EHP (EPDM) for water services, temperature range -30 degrees F to 250 degrees F.
   2. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Style 177N.
      a. Gasket: Elastomer composition for operating temperature range from -30 degrees F to 250 degrees F.
      b. Accessories: Zinc-electroplated steel or stainless steel bolts, nuts and washers.
   3. AGS two-segment couplings for pipe sizes 14” and larger, with wide-width FlushSeal gasket and lead-in chamfer on housing key. Basis of Design: Victaulic Style W07 (rigid) and Style W77 (flexible).
   4. Compatibility: All materials shall be compatible with 35 percent propylene glycol.

2.6 BALL VALVES

A. Manufacturers:

1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc.
5. Stockham Valves & Fittings.

B. 2 inches and Smaller: MSS SP-110, 400 psi WOG, one piece bronze body, chrome plated brass ball, regular port, Teflon seats, blow-out proof stem, solder or threaded ends lever handle.

2.7 BUTTERFLY VALVES

A. Manufacturers:
1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc.
5. Stockham Valves & Fittings.
6. Victaulic.

B. 2-1/2 inches and Larger: MSS SP-67, Class 150.
1. Body: Cast or ductile iron, wafer, lug or grooved ends, stainless steel stem, extended neck. Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.
2. Disc: Nickel-plated ductile iron.
3. Seat: Resilient replaceable EPDM.
   a. Pressure responsive for sizes through 12 inches.
4. Handle and Operator: Infinite position lever handle with memory stop.

2.8 PIPE HANGERS AND SUPPORTS

A. Refer to Section 23 05 29.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. Refer to Section 23 25 00.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install pipe hangers and supports in accordance with Section 23 05 29.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install heating water and chilled water piping in accordance with ASME B31.9 (and ASME B31.1 as applicable).

B. Route piping parallel to building structure and maintain gradient.

C. Install piping to conserve building space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.
   1. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
   2. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around pipe penetration. Match materials and finishes of adjacent work.

F. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.

G. Install pipe identification in accordance with Section 23 05 53.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

I. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with .

J. Slope hydronic piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe aligned.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

L. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

M. Valves: Install with stems upright or horizontal, not inverted.

N. Insulate piping and equipment; refer to Section 23 07 00.

O. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

3.4 INSTALLATION – PP-R PIPING JOINTS

A. Install fittings and joints using socket-fusion, electrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

B. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.

C. Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F2389 and the manufacturer's specifications.

D. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

3.5 FIELD QUALITY CONTROL

A. Final System Pressure Test: Test heating water piping system and chilled water piping system in accordance with ASME B31.9 (and ASME B31.1 as applicable).
   1. Test Type: Hydrostatic
   2. Minimum Testing Pressure: 1.5 times design pressure. Refer to Drawing Schedules.
   3. Maximum Testing Pressure: 100 psig.

3.6 CLEANING

A. As directed by Water Treatment Contractor. Refer to Section 23 25 00.

END OF SECTION

SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pressure gages.
   2. Pressure gage taps.
   3. Thermometers.
   4. Thermometer supports.
   5. Test plugs.
   6. Flexible connectors.
   7. Air vents.
   8. Strainers.
   9. Flow controls.
   10. Relief valves.
   11. Glycol solution.

B. Related Sections:
   1. Section 23 21 13 - Hydronic Piping: Execution requirements for piping connections to products specified by this section.
   2. Section 23 21 23 - Hydronic Pumps: Execution requirements for piping connections to products specified by this section.
   3. Section 23 25 00 – HVAC Water Treatment: Execution requirements for pipe cleaning.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B40.100 - Pressure Gauges and Gauge Attachments.
   2. ASME BPVC Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.
   2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

C. American Water Works Association:
   1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
   2. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
   3. AWWA C702 - Cold-Water Meters - Compound Type.
   4. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
   5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

D. Underwriters Laboratories Inc.:
   1. UL 393 - Standard for Indicating Pressure Gauges for Fire-Protection Service.
   2. UL 404 - Standard for Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. Flexible Connectors: Provide at or near pumps and other motorized equipment where piping configuration does not absorb vibration.

1.5 SUBMITTALS

A. Product Data: Submit for manufactured products and assemblies used in this Project.

1. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
2. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
3. Submit electrical characteristics and connection requirements.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of actual locations of components and instrumentation, flow controls.

B. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.7 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.11 FIELD MEASUREMENTS

A. Verify field measurements before fabrication.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers:
1. Ashcroft, Inc.
2. H. O. Trerice Company.
3. Weiss Instruments, Inc.

B. Gage: ASME B40.100, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
1. Case: Fiberglass reinforced polypropylene.
2. Bourdon Tube: Brass.
3. Dial Size: 4-1/2 inch diameter.
4. Mid-Scale Accuracy: One percent.
5. Units of Measure: Both psi and kPa.
6. Range: 0 through 100 psi.

2.2 PRESSURE GAGE TAPS

A. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Ashcroft, Inc.
   2. H. O. Trerice Company.
   3. Weiss Instruments, Inc.

B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Stem: Brass, 3/4 inch NPT, Length as required for proper fluid sensing.
   4. Accuracy: 2 percent.
   5. Units of Measure: Both °F and °C.
   6. Range:
      a. Hot Water: 30°F to 240°F.
      b. Chilled Water: 0°F to 160°F.

C. Light-Powered Digital Thermometer: NEMA-4X, adjustable angle, LCD digits display, cast aluminum case with epoxy finish, cast aluminum adjustable joint with positive locking device.
   1. Size: 7 inch scale.
   2. Window: Clear Lexan.
   3. Stem: Brass, 3/4 inch NPT, Length as required for proper fluid sensing.
   4. Accuracy: 1 percent.
   5. Units of Measure: Both °F and °C.
   6. Range:
      a. Hot Water: 30°F to 240°F.
      b. Chilled Water: 0°F to 150°F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.5 TEST PLUGS

A. 1/4 inch NPT or 1/2 inch NPT brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:
   1. Neoprene core for temperatures up to 200°F.
   2. Nordel core for temperatures up to 350°F.
   3. Viton core for temperatures up to 400°F.

2.6 FLEXIBLE CONNECTORS

A. Minimum 9 inches long with copper tube ends; for maximum working pressure 300 psig.
   1. Rigidly Mounted Pumps: Corrugated stainless steel hose with single layer of stainless steel exterior braiding.
   2. Pumps with Inertia Bases: Double-sphere neoprene rubber.
   3. Three Victaulic flexible type couplings may be used in lieu of a flexible connector for vibration attenuation at equipment connections. The couplings shall be placed in close proximity to the source of vibration.

2.7 AIR VENTS - MANUAL

A. Manufacturers:
   1. Refer to Ball Valves in Section 23 21 13.

B. Manual Type:
   1. Short vertical section of pipe to form air chamber, with 1/2 inch brass ball valve with threaded hose end at top of chamber.
   2. Application: All locations except at Air Separators.
   3. Contractors Option: 3/4 inch brass ball valve

C. NOTE: Coin-operate air vents are not acceptable.

2.8 AIR VENTS - AUTOMATIC

A. Manufacturers:
   1. Bell & Gossett (Xylem, Inc.). Model: 107A.

B. Float Type:
   1. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.
      a. Application: Air Separators only.

2.9 STRAINERS

A. Size 2 inch and Smaller:
   1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch:
   1. Flanged or grooved iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

C. Size 5 inch and Larger:
   1. Flanged or grooved iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.10 FLOW CONTROL VALVES

A. Manufacturers:
   1. Bell & Gossett (Xylem, Inc.).
   2. Griswold Controls
   3. Taco, Inc.
   4. Victaulic Company.

B. Construction: Brass or bronze body with union on inlet, and outlet, temperature and pressure test plug on inlet, and combination blow-down and back-flush drain.

C. Calibration: Control within 5 percent of design flow over entire operating pressure.

D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

E. Accessories: Ball valve on outlet.

2.11 RELIEF VALVES

A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.12 GLYCOL SOLUTION

A. Refer to Section 23 25 00.

PART 3 EXECUTION

3.1 INSTALLATION - THERMOMETERS AND GAGES

A. Install one pressure gage for each pump, locate taps as detailed on Drawings.

B. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

E. Coil and conceal excess capillary on remote element instruments.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 INSTALLATION - HYDRONIC PIPING SPECIALTIES

A. Drain and reserve existing glycol solution, if any, and turn over to Owner.

B. Install manual air vents at system high points.

C. Provide air separator on suction side of system circulation pump and connect to expansion tank.

D. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

E. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

F. Pipe relief valve outlet to nearest floor drain.

3.3 CLEANING

A. Refer to Section 23 25 00.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not install hydronic pressure gauges until after systems are pressure tested.

END OF SECTION

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SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refrigerant piping.
   2. Unions, flanges, and couplings.
   3. Pipe hangers and supports.
   4. Refrigerant moisture and liquid indicators.
   5. Valves.
   6. Refrigerant filter-driers.
   7. Refrigerant solenoid valves.

B. Related Sections:
   1. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Piping materials for refrigerant systems.
   2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports, sleeves, for placement by this section.
   3. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolation for placement by this section.
   4. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
   5. Section 23 07 00 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.

1.2 REFERENCES

A. Air-Conditioning, Heating, & Refrigeration Institute:
   1. AHRI 710 - Performance Rating of Liquid-Line Driers.
   2. AHRI 760 - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 15 - Safety Standard for Refrigeration Systems.

C. American Society of Mechanical Engineers:
   1. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
   2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.

D. ASTM International:
   1. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

E. American Welding Society:
   1. AWS A5.8 - Filler Metals for Brazing & Braze Welding.
   2. AWS D1.1/D1.1M - Structural Welding Code - Steel.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

B. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

C. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

D. Provide pipe hangers and supports in accordance with ASME B31.5.

E. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

1.4 SUBMITTALS

A. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.

B. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
   4. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:
      a. Refrigerant moisture and liquid indicators.
      b. Refrigerant filter-driers.
      c. Refrigerant solenoid valves.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

D. Welders' Certificate: Include welders' certification of compliance with ASME BPVC Section IX, AWS D1.1/D1.1M, or equivalent.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves, equipment, and refrigerant accessories.

B. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.

C. Perform Work in accordance with AWS D1.1/D1.1M for welding hanger and support attachments to building structure.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate trenching, excavating, bedding, and backfilling of buried piping systems with General Contractor.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 UNIONS, FLANGES, AND COUPLINGS

A. 2 inches and Smaller:
   1. Copper Pipe: Bronze, soldered joints.

B. 2-1/2 inches and Larger:
   1. Copper Piping: Bronze.

2.3 PIPE HANGERS AND SUPPORTS

A. Refer to Section 23 05 29.

B. Conform to ASME B31.5.

2.4 REFRIGERANT MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Alco Controls Div, Emerson Electric Co.
   2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
   3. Sporlan Valve Co.

B. Indicators:
   1. Port: Single, UL listed.
   2. Body: Copper or brass, flared or solder ends.
   3. Sight glass: Color-coded paper moisture indicator and plastic cap.
   4. Maximum working pressure: 500 psig
   5. Maximum working temperature: 200 degrees F.

2.5 VALVES

A. Manufacturers:
   1. Alco Controls Div, Emerson Electric Co.
   2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
   3. Sporlan Valve Co.

B. Diaphragm Packless Valves:
   1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
   2. Phosphor bronze and stainless steel diaphragms, rising stem and hand wheel.
   3. Stainless steel spring, nylon seats, disc with positive back seating.
   4. Maximum working pressure: 500 psig.

5. Maximum working temperature: 275 degrees F.

C. Packed Angle Valves:
1. Forged brass or nickel-plated forged steel, solder or flared ends.
2. Forged brass seal caps with copper gasket, rising stem and seat with back seating, molded stem packing.
3. Maximum working pressure: 500 psig.
4. Maximum working temperature: 275 degrees F.

D. Ball Valves:
1. Two piece forged brass body with teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered ends.
2. Maximum working pressure: 500 psig.
3. Maximum working temperature: 325 degrees F.

E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
2. Maximum working pressure: 500 psig.

F. Refrigerant Check Valves:
1. Manufacturers:
a. Alco Controls Div, Emerson Electric Co.
b. Parker Hannifin Corp., Refrig. & Air Cond. Div.
c. Sporlan Valve Co.
2. Straight Through Type:
a. Spring, neoprene seat.
b. Maximum working pressure: 500 psig.
c. Maximum working temperature: 250 degrees F.

2.6 REFRIGERANT FILTER-DRIERS

A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.

B. Permanent Straight Through Type:
1. AHRI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500 psig.

2.7 REFRIGERANT SOLENOID VALVES

A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.

B. Valve: AHRI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly, integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psig. Stem designed to allow manual operation in case of coil failure.

C. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install pipe hangers and supports in accordance with ASME B31.5 and Section 23 05 29.

3.5 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.

E. Install pipe identification in accordance with Section 23 05 53.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Flood refrigerant piping system with nitrogen when brazing.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds. Install valves with stems upright or horizontal, not inverted.

J. Insulate piping and equipment; refer to Section 23 07 00.

K. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

L. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

M. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

N. Fully charge completed system with refrigerant after testing.

O. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Install refrigerant piping in accordance with ASME B31.5.

3.6 INSTALLATION - REFRIGERANT SPECIALTIES

A. Refrigerant Liquid Indicators:
   1. Install line size liquid indicators in main liquid line downstream of condenser.
   2. When receiver is provided, install line size liquid indicators in liquid line downstream of receiver.
   3. Install line size liquid indicators downstream of liquid solenoid valves.

B. Refrigerant Valves:
   1. Install service valves on compressor suction and discharge.
   2. Install gage taps at compressor inlet and outlet.
   3. Install gage taps at hot gas bypass regulators, inlet and outlet.
   4. Install check valves on condenser liquid lines on multiple condenser systems.
   5. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.

C. Install pressure relief valves on ASME receivers. Install relief valve discharge piping to terminate outdoors.

D. Filter-Dryers:
   1. Install permanent filter-dryers in liquid lines.

E. Solenoid Valves:
   1. Install in liquid line of each system.
   2. Install in liquid line of single or multiple evaporator systems.

F. Refrigerant Circuit Access Ports:
   1. Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access.
      a. Exception: Not applicable to refrigerant access ports or equipment installed in controlled areas such as on roofs with locked access hatches or doors.

3.7 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test refrigeration system with dry nitrogen to 200 psig.

C. Repair leaks.

D. Retest until no leaks are detected.

END OF SECTION

SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. System cleaner.
   2. Closed system treatment (water).
   3. Glycol solution.

B. Related Sections:
   1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
   2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electrical connections specified by this section.

1.2 REFERENCES

A. NONE

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. Provide system to treat water available at project site to maintain the following characteristics of water in closed systems:
   1. Hardness: 7 grains or less.
   2. Iron: Per equipment and piping manufacturers' requirements.
   3. Total Dissolved Solids: Per equipment and piping manufacturers' requirements.
   4. Total Alkalinity: Per equipment and piping manufacturers' requirements.
   5. Silica: Per equipment and piping manufacturers' requirements.
   6. pH: Per equipment and piping manufacturers' requirements.

1.5 SUBMITTALS

A. Product Data: Submit chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

B. Glycol Solution Test: Provide written test of glycol solution strength.

1.7 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with Authority Having Jurisdiction standard for addition of non-potable chemicals to building systems and for discharge to public sewers.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience with water analysis laboratories and full time service personnel.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 SYSTEM CLEANER

A. Product Description: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

2.2 CLOSED SYSTEM TREATMENT (WATER)

A. Sequestering agent to reduce deposits and adjust pH.
   1. Corrosion inhibitors: Nitrate-based solutions.

2.3 GLYCOL SOLUTION

A. Inhibited propylene glycol and water solution mixed 35 percent glycol and 65 percent dilution water, suitable for operating temperatures from -30 degrees F to 250 degrees F.

PART 3 EXECUTION

3.1 PREPARATION

A. Drain and reserve existing glycol solution, if any, and turn over to Owner.

B. Operate, fill, start and vent systems prior to cleaning.

C. Use water meter to record capacity in each system.

D. Place terminal control valves in open position during cleaning.

E. Flush system of dirt and debris.

3.2 FIELD QUALITY CONTROL

A. Mechanical Contractor to test for strength of glycol and dilution water solution and submit written test results.

3.3 CLEANING

A. Clean systems as directed by Engineer.
   1. Engineer to approve of flushing test samples prior to adding system cleaner.

B. Concentration:
   1. As recommended by manufacturer.

C. Hot Water Heating Systems:
   1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
   2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
   3. Circulate for 6 hours at design temperatures, then drain.
   4. Refill with clean water and repeat until system cleaner is removed.

D. Chilled Water Systems:
   1. Circulate for 48 hours, then drain systems as quickly as possible.
   2. Refill with clean water, circulate for 24 hours, then drain.
   3. Refill with clean water and repeat until system cleaner is removed.

E. Use neutralizer agents on recommendation of system cleaner supplier and acceptance of Architect/Engineer.

F. Remove, clean, and replace strainer screens and side-stream filter cartages.

G. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.4 INSTALLATION

A. Once cleaning is finished and approved by Engineer, feed glycol solution to system with make-up system with pressure regulator, venting system high points.
   1. System Fill Pressure: 12 psig - to be confirmed by Mechanical contractor prior to system fill.

END OF SECTION

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SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Duct Materials.
   2. Insulated flexible ducts.
   3. Single wall longitudinal-seam round ducts.
   4. Single wall spiral-seam round ducts.
   5. Transverse duct connection system.
   6. Ductwork fabrication.
   7. Type I kitchen hood exhaust ductwork fabrication.
   8. Type II kitchen hood exhaust ductwork fabrication.
   9. Double wall perforated ductwork.
   10. Kiln & fume hood exhaust duct fabrication.

B. Related Sections:
   1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
   2. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A90/A90M - Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
   3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
   2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
   3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Air Duct Leakage Test Manual.
   2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
   1. UL 181 - Standard for Factory-Made Air Ducts and Connectors.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

A. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

C. Construct ductwork to NFPA 90A (as well as NFPA 90B and NFPA 96 as applicable) standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate location of Additions and Remodel phase duct connections to EMT Lab phase ductwork (shown as existing on Drawings). Coordinate with EMT Lab Contractor.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.

B. Carbon Steel Ducts: ASTM A568/A568M.

C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

D. Fasteners: Rivets, bolts, or sheet metal screws.

E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded. Provide aluminum/stainless hangers and duct supports where aluminum/stainless ductwork is specified.

F. Finish: Paintable for exposed, uninsulated duct.

2.2 INSULATED FLEXIBLE DUCTS

A. Product Description: Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
   1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
   2. Maximum Velocity: 4000 fpm.
   3. Temperature Range: -10 degrees F to 160 degrees F.

4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

2.3 SINGLE WALL LONGITUDINAL-SEAM ROUND DUCTS

A. Product Description: UL 181, Class 1, round longitudinal snaplock seam duct constructed of galvanized steel.

B. Longitudinal seam ducts are only allowed for 14-inch or smaller diameter ducts for 2-inch or less duct pressure classifications.

2.4 SINGLE WALL SPIRAL ROUND DUCTS

A. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

B. This type of duct is also available in type 304 or 316 stainless steel and aluminum. Modify gauges to suit project conditions where applicable.

C. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

D. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.5 TRANSVERSE DUCT CONNECTION SYSTEM

A. Product Description: SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

B. Spiral Duct Product Description: 16-gauge flange system with barrel clamp and bolt lock systems and neoprene gasket.

2.6 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2.7 TYPE I KITCHEN HOOD EXHAUST DUCTWORK FABRICATION

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

B. Exposed Type I Kitchen Hood Exhaust Ducts: Construct of 18-gauge stainless steel ASTM A167, type 304 using continuous external welded joints.

C. Concealed Type I Kitchen Hood Exhaust Ducts: Construct of 16-gauge carbon steel or 18-gauge stainless steel ASTM A167, type 304 using continuous external welded joints.

2.8 TYPE II KITCHEN HOOD EXHAUST DUCTWORK FABRICATION

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

B. Type II Kitchen Hood Exhaust Ducts: Construct of 18-gauge stainless steel ASTM A167, type 304 using continuous external welded joints.

2.9 DOUBLE-WALL PERFORATED DUCTWORK

A. Application: Provide double wall ductwork for the first 25 ft or supply and return ductwork on all air handling equipment serving occupied spaces with cfm quantities over 2,000 cfm.

B. Description: Construction shall be a solid sheet metal outer pressure shell and a sheet metal inner liner with a layer of insulation sandwiched between.

C. Sheet metal Liner: Provide perforated 22 gage galvanized steel liner of interior duct insulation. Perforations to be 3-32-inch diameter on 3/16 to ¼ inch on center pattern.
   1. Provide 1 inch thick Acousti-Line™ or equal insulation with an acrylic coating that resists air erosion of fibers and the growth of fungus and bacteria.

2.10 KILN AND FUME HOOD EXHAUST DUCTWORK FABRICATION

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

B. Type II Hood Exhaust Ducts: Construct of 18-gauge stainless steel ASTM A167, type 304 using continuous external welded joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION - GENERAL

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.

D. Install duct hangers and supports in accordance with Section 23 05 29.

E. Use double nuts and lock washers on threaded rod supports.

F. Connect flexible ducts to metal ducts with draw bands and adhesive.

G. Set plenum doors 6 to 12 inches above floor. Arrange door swing so fan static pressure holds door in closed position.

H. All takeoffs shall be pre-manufactured high efficiency with integral volume damper and neoprene gasket flange seal.

I. Seam and joint sealing:
   1. Seam duct seams and joints according to SMACNA - HVAC Duct Construction Standards - Metal and Flexible for duct pressure class indicated.
   2. Seal all transverse joints, longitudinal joints, and duct penetrations.
   3. Seal to achieve no visible or audible leaks.
   4. Seal externally insulated ducts before insulation is applied.
   5. Seal exposed joints internally during installation. Do not use external sealant on exposed ducts
   6. Outside air and exhaust/relief air ducts shall be sealed water-tight and sloped to drain.
   7. MINNESOTA: Ducts shall be sealed to meet MN Rules 1346.0603. Pressure sensitive tape shall **NOT** be used as the primary sealant.

J. Where ductwork penetrates floor, ceiling, or wall, close off space between duct and adjacent work with insulation and caulk airtight. Provide close fitting metal collar at both sides of penetration.
   1. For large holes in wall, floor, and ceiling assemblies: Infill, patch, and seal the annular space around duct penetration. Match materials and finishes of adjacent work.

K. Install firestopping at fire rated construction perimeters and openings containing penetrating ductwork. Refer to Section 23 05 29 and Division 07.

3.3 INSTALLATION – KITCHEN HOOD EXHAUST DUCTS

A. Install residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out.

B. Type I Kitchen hood exhaust ducts: Use stainless steel for ductwork exposed to view and stainless steel or carbon steel where ducts are concealed.

C. Install ducts to slope not less than one-fourth unit vertical in 12 units horizontal toward the hood or toward an approved reservoir.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

C. Connect air terminal units, air outlets, and air inlets to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.5 FIELD QUALITY CONTROL

A. Type I Kitchen hood exhaust ducts: Prior to use or concealment of any portion of a Type I hood duct, the duct shall be light, air, or water tested, per the Minnesota Mechanical and Fuel Gas Code.

3.6 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.7 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Kitchen Hood Exhaust	Carbon Steel
Dishwasher Exhaust	Stainless Steel, Aluminum
Fume Hood Exhaust	Stainless Steel
Kiln Hood Exhaust	Stainless Steel
Locker Room Supply & Exhaust	Aluminum
Natatorium Supply, Return & Exhaust	Aluminum
Supply & Return, 1st 25 FT from RTU (>2000 CFM)	Double-Wall Perforated
Outside Air Intake	Galvanized Steel

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Supply	Refer to Drawings for system external static pressure. Pressure class to not be less that equipment external static pressure.
Return and Relief	1 inch wg regardless of velocity.
General Exhaust	1 inch wg regardless of velocity.
Kitchen Exhaust	1 inch wg regardless of velocity.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Duct access doors.
2. Dynamic fire dampers.
3. Ceiling radiation dampers.
4. Smoke dampers.
5. Combination fire-and-smoke dampers.
6. Volume control dampers.
7. Back-draft dampers.
8. Flexible duct connections.
9. Control air dampers.
10. Pressure-independent zone dampers.
11. Air control valves.
12. Duct-mounted smoke detectors.
13. Grease duct fire wrap.
14. Smoke Vents.

B. Related Sections:
1. Section 23 09 00 - Instrumentation and Control for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
2. Section 23 09 23 - Direct-Digital Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
3. Section 23 09 53 - Pneumatic and Electric Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
4. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
1. AMCA 500 - Laboratory Methods of Testing Louvers for Rating.

B. ASTM International:
1. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.

C. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
1. UL 555 - Standard for Fire Dampers.
2. UL 555C - Standard for Ceiling Dampers.
3. UL 555S - Standard for Smoke Dampers.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Fire dampers including locations and ratings.
   2. Smoke dampers including locations and ratings.

B. Product Data: For fire dampers, smoke dampers, and combination fire and smoke dampers submit the following:
   1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.
   3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

C. Manufacturer's Installation Instructions: Submit for fire dampers, ceiling radiation dampers, smoke dampers, and combination fire and smoke dampers.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors and test holes.

B. Operation and Maintenance Data: Submit for fire dampers, ceiling radiation dampers, smoke dampers, and combination fire and smoke dampers.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Dampers tested, rated and labeled in accordance with the latest UL requirements.

C. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

C. Storage: Store materials in a dry area indoor, protected from damage.

D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Coordinate Work where appropriate with building control Work.

1.11 WARRANTY

A. Furnish one year manufacturer warranty for duct accessories.

PART 2 PRODUCTS

2.1 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

2.2 DYNAMIC FIRE DAMPERS

A. Manufacturers:
   1. Greenheck Fan Corporation.
   2. Metal-Fab, Inc.
   3. Nailor Industries Inc.
   4. National Controlled Air (Metal Industries, Inc.).
   5. Pottorff (PCI Industries, Inc.).
   6. Ruskin Company.
   7. United Enertech.

B. Fabricate in accordance with NFPA 90A and UL 555.

C. Fire Resistance:
   1. UL 555 classified and labeled.
   2. Assemblies of less than 3-hour fire rating: 1-1/2 hours.
   3. Assemblies of 3-hour or greater fire rating: 3 hours.

D. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

E. Construction:
   1. Integral Sleeve Frame: Minimum 20 gage roll formed galvanized steel.
   2. Blades:
      a. Style: Curtain type.
      b. Action: Spring or gravity closure upon fusible link release.
      c. Material: Minimum 24 gage roll formed, galvanized steel.
   3. Closure Springs: Type 301 stainless steel, constant force type, if required.

F. Fusible Link Release Temperature: 50 degrees F above normal temperature within duct system, but not less than 160 degrees F.

G. Mounting: Vertical or horizontal.

H. Finish: Mill galvanized.

2.3 STATIC FIRE DAMPERS

A. Manufacturers:
   1. Greenheck Fan Corporation.
   2. Metal-Fab, Inc.
   3. Nailor Industries Inc.
   4. National Controlled Air (Metal Industries, Inc.).
   5. Pottorff (PCI Industries, Inc.).
   6. Ruskin Company.
   7. United Enertech.

B. Fabricate in accordance with NFPA 90A and UL 555.

C. Fire Resistance:
   1. UL 555 classified and labeled.
   2. Assemblies of less than 3-hour fire rating: 1-1/2 hours.
   3. Assemblies of 3-hour or greater fire rating: 3 hours.

D. Air Flow Rating: UL approved for dual directional air flow.

E. Integral Sleeve Frame: Minimum 20 gage by 12 inches roll formed, galvanized steel.
   1. Factory Sealant: Apply to dampers in HVAC systems with pressures to maximum 4 inches wg.

F. Blades:
   1. Style: Curtain type, in airstream.
   2. Action: Spring or gravity closure upon fusible link release.
   3. Orientation: Horizontal.
   4. Material: Minimum 24 gage roll formed, galvanized steel.

G. Closure Springs: Type 301 stainless steel, constant force type, if required.

H. Temperature Release Device:
   1. Fusible link, 50 degrees F above normal temperature within duct system, but not less than 160 degrees F.
   2. Mounting: Vertical or horizontal.

I. Finish: Mill galvanized.

J. Picture Frame Mounting Angles:
   1. One-piece, roll formed retaining angles.
   2. Factory matched and shipped attached to damper.

2.4 CEILING FIRE DAMPERS

A. Manufacturers:
   1. Greenheck Fan Corporation.
   2. Metal-Fab, Inc.
   3. Nailor Industries Inc.
   4. National Controlled Air (Metal Industries, Inc.).
   5. Pottorff (PCI Industries, Inc.).
   6. Ruskin Company.
   7. United Enertech.

B. Fire Resistance:
   1. UL 555C classified and labeled.
   2. Assemblies of less than 3-hour fire rating: 1-1/2 hours.
   3. Assemblies of 3-hour or greater fire rating: 3 hours.

C. Air Flow Rating: UL approved for dual directional air flow.

D. Frame: minimum 3 inches by minimum 20 gage galvanized steel with roll formed ridge for blade stop.

E. Blades:
   1. Style: Two-piece, single-thickness with blade insulation, hinged in center, and held open with fusible link.
   2. Action: Butterfly.
   3. Orientation: Horizontal.
   4. Material: Minimum 20 gage galvanized steel.

F. Hinge: Spring stainless steel, mechanically attached to blades.

G. Mounting: Horizontal.

H. Temperature Release Device: Fusible link, 50 degrees F above normal temperature within duct system, but not less than 160 degrees F.

I. Finish: Mill galvanized.

J. Performance Data:
   1. Pressure Drop: Maximum 0.1 inches w.g. at 500 fpm across 18 x 18 inch damper.

K. Fusible Volume Adjust: UL classified.

L. Extended Frame:
1. Rectangular Dampers: 6 inches.
2. Round Dampers: 6-1/2 inches.

2.5 SMOKE DAMPERS

A. Manufacturers:
1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. National Controlled Air (Metal Industries, Inc.).
4. Pottorff (PCI Industries, Inc.).
5. Ruskin Company.
6. United Enertech.

B. Fabricate in accordance with NFPA 90A and UL 555S.

C. Leakage Rating: Class II, maximum of 20 cfm at 4 inches wg differential pressure.

D. Damper Temperature Rating: 250 degrees F.

E. Frame: 16 gage, galvanized steel.

F. Blades:
1. Style: Airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Orientation: Horizontal.
4. Material: Minimum 16 gage equivalent thickness, galvanized steel.
5. Width: Maximum 6 inches.

G. Bearings: Stainless steel pressed into frame.

H. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

I. Linkage: Concealed in frame.

J. Actuator:
1. Type: Electric 24 volt, 60 hertz, two-position, fail close.
2. Mounting: External or internal.

K. Sleeve: Factory installed 20 gage sleeve, minimum 12 inches long.

L. Finish: Mill galvanized.

M. Smoke Detectors and Wiring: By Division 28.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. National Controlled Air (Metal Industries, Inc.).
4. Pottorff (PCI Industries, Inc.).
5. Ruskin Company.
6. United Enertech.

B. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.

A. Fire Resistance:
1. UL 555 classified and labeled.
2. Assemblies of less than 3-hour fire rating: 1-1/2 hours.

3. Assemblies of 3-hour or greater fire rating: 3 hours.

B. Leakage Rating: Class II, maximum of 20 cfm at 4 inches wg differential pressure.

C. Damper Temperature Rating: 50 degrees F.

D. Fusible Link Release Temperature: 50 degrees F above normal temperature within duct system, but not less than 160 degrees F.

E. Frame: 16 gage, galvanized steel.

F. Blades:
1. Style: Airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Orientation: Horizontal.
4. Material: Minimum 16 gage equivalent thickness, galvanized steel.
5. Width: Maximum 6 inches.

G. Bearings: Stainless steel pressed into frame.

H. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

I. Linkage: Concealed in frame.

J. Release Device: Close in controlled manner and allow damper to be automatically reset.

K. Actuator:
1. Type: Electric 24 volt, 60 hertz, two-position, fail close.
2. Mounting: External or internal.

L. Finish: Mill galvanized.

M. Factory installed sleeve and mounting angles. Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.

N. Smoke Detectors and Wiring: By Division 28.

2.7 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

D. Quadrants:
1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.8 BACK-DRAFT DAMPERS

A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel, or extruded aluminum. Blades, maximum 6 inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

B. Per 2020 Minnesota Energy Code: Provide back-draft dampers for all exhaust fan systems with airflow less than 300-cfm.

2.9 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and [as indicated on Drawings.

B. Connector: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
   2. Net Fabric Width: Approximately 6 inches wide.
   3. Metal: 3 inch wide, 24 gage galvanized steel.

2.10 CONTROL AIR DAMPERS

A. Performance: Test in accordance with AMCA 500.

B. Per 2020 Minnesota Energy Code: Provide motorized 2-position or modulating control air dampers for all exhaust fan systems with airflow equal to or greater than 300-cfm.

C. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 16 gage.
   1. Outdoor/Relief Applications: Insulated, thermally-broken frame.

D. Blades: Galvanized steel, maximum blade size 48 inches wide, 48 inches long, minimum 22 gage, attached to minimum 1/2 inch shafts with set screws.

E. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.

F. Jamb Seals: Stainless steel spring.

G. Shaft Bearings: Graphite impregnated nylon sleeve, with thrust washers at bearings.

H. Linkage Bearings: Graphite impregnated nylon.

I. Air Damper Leakage:
   1. Outside/Relief Damper: Maximum leakage rate of 3.0 cfm per square foot at 1.0 inches wg pressure differential.
   2. General Damper: Less than one percent based on approach velocity of 2000 fpm and 4 inches wg.

J. General Damper Leakage: Maximum leakage rate of 1 percent at 4.0 inches wg pressure differential.

K. Damper Leakage: Less than one percent based on approach velocity of 2000 fpm and 4 inches wg.

L. Maximum Pressure Differential: 6 inches wg.

M. Temperature Limits: - 40 to 200 degrees F.

2.11 PRESSURE-INDEPENDENT ZONE DAMPERS

A. Manufacturers:
   1. Trox. Model: RN Series.
   2. Price Industries.

B. Used for all Induction displacement unit and chilled beam applications.

C. Circular volume flow controllers for constant volume systems, mechanical system-powered (external power supply not required), for supply and extract air. Consists of a casing with a control damper blade shaft mounted, supported on bearings with a bellows and an external cam plate with leaf spring.

D. Low-friction bellows, also operates as an oscillation damper the flow rate can be set with an external scale. Close tolerances on flow rate. Independent of orientation and maintenance-free. The standard construction of controller is supplied with a set reference flow rate. The required flow rate should be set on site by the contractor.

E. Spigots suitable for ducts with groove for lip seal. Differential pressure range 0.2 to 4.0 inch WG (size 3, 0.4 to 4.0 inch WG), flow rate range 4 : 1.

F. Materials: Casing and control damper blade made from galvanized sheet steel, plain bearings made of plastic. Polyurethane bellows.

G. Actuator, 24 VAC.

2.12 AIR CONTROL VALVES:

A. Manufacturers:
1. ENVIRO-TEC (Johnson Controls, Inc.).
2. Nailor Industries, Inc.
3. Krueger-HVAC (Air System Components).
4. Price Industries.
5. Titus.
6. Trane (Ingersoll Rand).
7. Tuttle and Bailey.

B. Product Description: Air control valve units for connection to central air systems, with electronic controls.

C. Identification: Furnish each air control valve unit with identification label and airflow indicator. Include unit nominal airflow.

D. Basic Assembly:
1. Casings: Minimum 22 gage galvanized steel.
2. Lining: Minimum 1/2 inch thick neoprene or vinyl coated glass fiber insulation, 1.5 lb./cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements with solid metal liner over insulation.
3. Access Panels: None.

E. Basic Unit:
1. Configuration: Air volume damper assembly inside unit casing.
   a. Locate control components outside unit. Do not provide protective metal shroud.
2. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inch inlet static pressure.
3. Mount damper operator to position damper normally open.

F. Airflow Sensor:
1. Cross configuration located at the unit inlet.
2. Sensor shall have pressure sensing ports for averaging unit air flow.
3. Sensor shall provide accuracy within 5 percent.

G. Direct Digital Controls shall be provided by Temperature Controls Contractor.
1. Sequence of Operation: Refer to Section 23 09 93.

2.13 DUCT-MOUNTED SMOKE DETECTOR

A. Refer to Drawing Schedules. Refer to Division 28.

2.14 GREASE DUCT FIRE WRAP

A. Manufacturers:
1. 3M Company.

B. Compliance:
1. ASTM E 2236.
2. ASTM E 84.

C. High-temperature fibrous thermal insulation blacket encapsulated with fiberglass-reinforced aluminized polyester foil.

D. Density: Nominal 6 lb/ft^3

E. Thickness: Nominal 1-1/2 inches

F. R-value: Minimum 6.3 degrees F-ft^2-hr/Btu.

G. Temperature Limit: 1,800 degrees F.

2.15 SMOKE VENTS:

A. Manufacturers
   1. Babcock-Davis
   2. Bilbo Company
   3. Milcor, Inc.

B. Material
   1. Aluminum: 11 gauge, mill finish.

C. Cover
   1. Formed metal cover with liner, internally stiffened to withstand a live load of 40psf.

D. Curb
   1. Single wall curb with EZ tab counterflash and mounting flange insulation 1 inch Polyiso R-6 in cover and around curb.

E. Hinge
   1. Heavy-duty pintle hinge with stainless steel hinge pins. Spring Gas spring with damper opens cover against 10psi snow load.

F. Hold Open Arm
   1. Zinc plated steel automatic hold open arm locks cover in open position.

G. Latch
   1. Zinc plated steel rotary latch designed to hold covers closed against 30 psf wind uplift. Opens manually by external and internal pull cables. Opens automatically with a fusible link at standard temperature 165 degrees F.

H. Certifications
   1. UL 793 Listed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rated walls are ready for fire damper installation.

B. Verify ducts and equipment installation are ready for accessories.

C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

C. Access Doors: Install access doors at the following locations and as indicated on Drawings:

1. Upstream and downstream of each reheat coil, including VAV boxes.
2. Before and after each automatic control damper.
3. Before and after each fire damper, smoke damper, and combination fire and smoke damper.

D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Review locations prior to fabrication.

E. Install fire dampers, combination fire and smoke dampers, and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
2. Install static fire dampers in locations where HVAC system fan is to cycle off during an alarm (via duct-mounted smoke detector or otherwise). Install dynamic fire dampers where HVAC system fan is to cycle off during an alarm.
3. Install dampers square and free from racking with blades running horizontally.
4. Do not compress or stretch damper frame into duct or opening.
5. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
6. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.3 INSTALLATION – AIR CONTROL VALVE

A. Connect to ductwork in accordance with Section 23 31 00.

B. Install ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.

D. Install transition piece to match flexible duct size to inlet or outlet of variable air volume terminal.

3.4 INSTALLATION – GREASE DUCT FIRE WRAP

A. Install per NFPA 96 and Minnesota Mechanical Code.

B. Butt joint inner layer.

3.5 DEMONSTRATION

A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 23 34 00 - HVAC FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Centrifugal fans.
   2. Downblast centrifugal roof fans.
   3. Upblast centrifugal roof fans.
   4. Ceiling fans.
   5. Roof ventilators.
   6. Energy recovery ventilator.
   7. Destratification fans.

B. Related Sections:
   1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
   2. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for resilient mountings and snubbers for fans for placement by this section.
   3. Section 23 07 00 - HVAC Insulation: Product requirements for power ventilators for placement by this section.
   4. Section 23 09 00 - Instrumentation and Control for HVAC: Product requirements for control components to interface with fans.
   5. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
   6. Section 23 31 00 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.
   7. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.
   8. Section 26 05 03 - Equipment Wiring Connections: Execution and product requirements for connecting equipment specified by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
   2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:
   1. AMCA 99 - Standards Handbook.
   2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
   3. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
   4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
   5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. Air-Conditioning, Heating, & Refrigeration Institute:
   1. AHRI 1060 - Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.

D. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. Underwriters Laboratories Inc.:
   1. UL 705 - Standard for Power Ventilators.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

B. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit fan manufacturers instructions.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Performance Ratings: Conform to AMCA 210.

C. Sound Ratings: AMCA 301, tested to AMCA 300.

D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

E. Balance Quality: Conform to AMCA 204.

F. Energy Recovery Unit Energy Transfer Rating: Meet AHRI 1060.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 CENTRIFUGAL FANS

A. Manufacturers:
   1. Acme Engineering and Manufacturing Corp.
   2. Greenheck Corp.
   3. Loren Cook Company.
   4. Penn Ventilation.
   5. Twin City Fan.
   6. Carnes.

B. Wheel and Inlet:
   1. Backward Inclined: Steel] construction with smooth curved inlet flange, back plate, backward curved blades welded or riveted to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

C. Housing:
   1. Steel, spot welded, braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
   2. Factory finish before assembly to manufacturer's standard.
   3. Bolted construction with horizontal flanged split housing.
   4. Fabricate plug fans without volute housing, in lined steel cabinet.

D. Bearings and Sleeves:
   1. Bearings: Pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA 9 L-50 life at 100,000 hours.
   2. Shafts: Hot rolled steel, ground and polished, with key way, protectively coated with lubricating oil, and shaft guard.

E. Accessories:
   1. Inlet/Outlet Screens: Galvanized steel welded grid.
   2. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.
   3. Fan speed controller.

F. Motor: Electronically commutated. Refer to Section 23 05 13.
   1. Direct drive.

G. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 1 enclosure.

H. Capacity:
   1. Refer to Drawings.

I. Electrical Characteristics and Components:
   1. Electrical Characteristics: In accordance with Section 26 05 03 and the Drawings:

2.2 DOWNBLAST CENTRIFUGAL ROOF FANS

A. Manufacturers:
   1. Acme Engineering and Manufacturing Corp.
   2. Greenheck Corp.
   3. Loren Cook Company.
   4. Twin City Fan.
   5. Carnes.
   6. Penn Ventilation.

B. Fan Unit: Downblast type. direct drive, with spun aluminum housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

C. Motor: Electronically commutated. Refer to Section 23 05 13.

D. Roof Curb: 24 inch high of galvanized steel construction with continuously welded seams , built-in cant strips, 2 inch insulation and curb bottom, and factory installed nailer strip.

E. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 1 enclosure.

F. Accessories:
   1. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.
   2. Fan speed controller.

G. Performance:
   1. Refer to Drawings.

H. Electrical Characteristics and Components:
   1. Electrical Characteristics: In accordance with Section 26 05 03 and Drawings.

2.3 UPBLAST CENTRIFUGAL ROOF FANS

A. Manufacturers:
   1. Acme Engineering and Manufacturing Corp.
   2. Greenheck Corp.
   3. Loren Cook Company.
   4. Penn Ventilation.
   5. Twin City Fan.
   6. Carnes.

B. Fan Unit: Upblast type. direct drive, spun aluminum housing with grease tray; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

C. Motor: Electronically commutated. Refer to Section 23 05 13.

D. Roof Curb: 24 inch high of galvanized steel construction with continuously welded seams, built-in cant strips, 2 inch insulation and curb bottom, and factory installed nailer strip.

E. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 Type 1 enclosure.

F. Accessories:
   1. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.
   2. Fan speed controller.

G. Performance:
   1. Refer to Drawings.

H. Electrical Characteristics and Components:
   1. Electrical Characteristics: In accordance with Section 26 05 03 and the following:

2.4 CEILING FANS

A. Manufacturers:
   1. Acme Engineering and Manufacturing Corp.
   2. Carnes.
   3. Greenheck Corp.
   4. Loren Cook Company.
   5. Twin City Fan.
   6. Penn Ventilation.

B. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge opening, integral outlet duct collar. Discharge position convertible by moving interchangeable panels.

C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.

D. Grille: Aluminum with baked white enamel finish.

E. Wheel: Centrifugal forward curved type constructed of injection molded or polypropylene resin.

F. Motor: Direct drive, open drip proof type with permanently lubricated sealed bearings and thermal overload protection.

G. Accessories:
   1. Wall cap with damper, round duct inlet.

H. Performance:

1. Refer to Drawing Schedules

I. Electrical Characteristics and Components:
1. Electrical Characteristics: In accordance with Division 26 and the Drawing Schedules:
2. Controls: Refer to Drawing Schedules.

2.5 GRAVITY ROOF VENTILATORS

A. Manufacturers:
1. Acme Engineering and Manufacturing Corp.
2. Greenheck Corp.
3. Loren Cook Company.
4. Penn Ventilation.
5. Twin City Fan.
6. Carnes.
7. Penn Ventilation.

B. Product Description: Square type, with aluminum constructed housing; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

C. Roof Curb: 24-inch high galvanized steel construction with continuously welded seams, built-in cant strips 2 inch insulation and curb bottom and factory installed nailer strip.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and low voltage motor drive, power open, spring return.

E. Per 2020 Minnesota Energy Code: Provide back-draft dampers for all exhaust fan systems with airflow less than 300-cfm.

F. Motor Operated Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and low voltage motor drive, power open, spring return.

G. Per 2020 Minnesota Energy Code: Provide motorized 2-position or modulating control air dampers for all exhaust fan systems with airflow equal to or greater than 300-cfm.

H. Performance:
1. Refer to Drawings.

2.6 DESTRATIFICATION FANS

A. Manufacturers:
1. Airius.

B. Description: Destratification fan designed to deliver columnar laminar flow of air from ceiling to floor. Fan to be selected according to space height and occupancy. Conforms to UL 507.

C. Motor: Electronically commuted motor.

D. Housing: PC/ABS resin, 5VA flame resistant rating.

E. Warranty: 3 years parts and workmanship.

2.7 INLINE FANS

A. Manufacturers:
1. Acme Engineering and Manufacturing Corp.
2. Greenheck Corp..
3. Loren Cook Company.
4. Penn Ventilation.
5. Twin City Fan

B. Configuration: Inline.

C. Centrifugal Fan Unit: Direct driven with injection molded resin housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge opening, integral inlet and outlet duct collar.

D. Fan mounted toggle switch for thermal overload protected motor.

E. Wheel: Double width, double inlet Centrifugal forward curved type constructed of injection molded or polypropylene resin.

F. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection, mounted on rubber-shear isolators.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.2 INSTALLATION

A. Secure roof fans and gravity ventilators with cadmium plated steel or aluminum lag screws to roof curb.

B. Suspended Cabinet Fans: Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Install backdraft dampers or motorized dampers on inlet to roof exhaust fans and gravity ventilators used in relief air applications.

D. Install destratification fans per manufacturer's instructions. Intake to be mounted 12 to 18 inches below ceiling deck.

E. Install safety screen where inlet or outlet is exposed.

3.3 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

3.4 PROTECTION OF FINISHED WORK

A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Variable volume terminal units.
   2. Induction displacement units.
   3. Active chilled beams.
   4. Air control valves.

B. Related Sections:
   1. Section 23 09 00 - Instrumentation and Control for HVAC: Product requirements for control components to interface with air terminal units.
   2. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
   3. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
   4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electrical connections to air terminal units specified by this section.

1.2 REFERENCES

A. Air-Conditioning, Heating, & Refrigeration Institute:
   1. AHRI 880 - Performance Rating of Air Terminals.
   2. AHRI 885 -Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

D. Underwriters Laboratories Inc.:
   1. UL 181 - Standard for Factory-Made Air Ducts and Connectors.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. Product Data: Submit data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings indicating airflow, static pressure, [heating coil capacity] and NC designation. Include electrical characteristics and connection requirements. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 inch to 4 inches wg.

B. Manufacturer's Installation Instructions: Submit support and hanging details, and service clearances required.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of units and controls components.

B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Test and rate air terminal units performance for air pressure drop, flow performance, and acoustical performance in accordance with AHRI 880 and AHRI 885. Attach AHRI seal to each terminal unit.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Coordinate Work with Section 23 09 00 - HVAC Instrumentation and Controls.

PART 2 PRODUCTS

2.1 SINGLE DUCT VARIABLE VOLUME AIR TERMINAL UNITS

A. Manufacturers:
   1. ENVIRO-TEC (Johnson Controls, Inc.).
   2. Nailor Industries, Inc.
   3. Krueger-HVAC (Air System Components).
   4. Price Industries.
   5. Titus.
   6. Trane (Ingersoll Rand).
   7. Tuttle and Bailey.

B. Product Description: Variable air volume terminal units for connection to central air systems, with electronic controls, and ,hot water heating coils.

C. Identification: Furnish each air terminal unit with identification label and airflow indicator. Include unit nominal airflow, maximum factory-set airflow and minimum factory-set airflow and coil type.

D. Basic Assembly:
   1. Casings: Minimum 22 gage galvanized steel.
   2. Lining: Minimum 1/2 inch thick neoprene or vinyl coated glass fiber insulation, 1.5 lb./cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements with solid metal liner over insulation.
   3. Access Panels: Refer to 23 33 00.

E. Basic Unit:
   1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
   2. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inch inlet static pressure.
   3. Mount damper operator to position damper normally open.

F. Hot Water Heating Coil:
   1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.
   2. Capacity: Refer to Drawings.

3. Provide access doors in VAV unit or adjacent ductwork for access both upstream and downstream of heating coil for cleaning.

G. Airflow Sensor:
   1. Cross configuration located at the unit inlet.
   2. Sensor shall have pressure sensing ports for averaging unit air flow.
   3. Sensor shall provide accuracy within 5 percent.

H. Thermostat: Electronic type with appropriate mounting hardware. Refer to Section 23 09 00.

I. Direct Digital Controls shall be provided by Temperature Controls Contractor.
   1. Sequence of Operation: Refer to Section 23 09 93.

2.2 INDUCTION DISPLACEMENT UNITS:

A. Refer to Section 23 82 16.

2.3 ACTIVE CHILLED BEAMS:

A. Refer to Section 23 82 16.

2.4 AIR CONTROL VALVES:

A. Refer to Section 23 33 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify ductwork is ready for air terminal installation.

3.2 INSTALLATION

A. Connect to ductwork in accordance with Section 23 31 00.

B. Install ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.

D. Support air terminal units connected by flexible duct independently of flexible duct.

E. Install transition piece to match flexible duct size to inlet or outlet of variable air volume terminal.

3.3 ADJUSTING

A. Temperature Controls Contractor: Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to minimum flow, as indicated in Drawing Schedules.

END OF SECTION

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SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Round Ceiling Diffusers
2. Linear Slot Diffusers.
3. Rectangular Ceiling Diffusers.
4. Ceiling Supply Registers/Grilles.
5. Exhaust and Return Registers and Grilles.
6. Louvers (ICC-500 Storm Shelter Rated)

B. Related Sections:

1. Section 23 09 00 - Instrumentation and Control for HVAC: Operators for adjustable louvers.
2. Section 23 09 23 - Direct-Digital Control System for HVAC: Operators for adjustable louvers.
3. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Laboratory Methods of Testing Louvers for Rating.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 70 - Method of Testing the Performance of Air Outlets and Air Inlets.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

C. Test and rate louver performance in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 RECTANGULAR CEILING DIFFUSERS

A. Manufacturers:

1. E. H Price Company.
2. Krueger.
3. Nailor Industries, Inc.
4. Titus.
5. Tuttle and Bailey.

B. (Type A) Ceiling Diffuser:

1. Type: Square, lay-in, multi-cone diffuser to discharge air in 360-degree, four-way pattern.
2. Frame: Inverted T-bar lay-in type. Provide sheet rock frame where indicated on Drawings.
3. Fabrication: Steel with white baked enamel finish.

2.2 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturers:

1. E. H Price Company.
2. Krueger.
3. Nailor Industries, Inc.
4. Titus.
5. Tuttle and Bailey.

B. (Type B) Egg Crate:

1. Type: Fixed grilles of 3/4 x 3/4 inch blades.
2. Fabrication: Aluminum with white baked enamel finish.
3. Frame: Inverted T-bar lay-in type.

C. (Type D) Grille:

1. Type: Louvered face grille.
2. Fabrication: Steel with white baked enamel finish.
3. Frame: 1-1/4 inch margin with countersunk screw mounting.

2.3 CEILING SUPPLY REGISTERS/GRILLES

A. Manufacturers:

1. E. H Price Company.
2. Krueger.
3. Nailor Industries, Inc.
4. Titus.
5. Tuttle and Bailey.

B. (Type C) Supply Grille:

1. Type: Double deflection louvered face register with individually adjustable bars.
2. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
3. Fabrication: Steel with white baked enamel finish.

4. Damper: Integral, gang-operated, opposed-blade type with removable key operator, operable from face.

2.4 CEILING SLOT DIFFUSERS

A. Manufacturers:

1. Anemostat Air Products.
2. E. H Price Company.
3. Krueger.
4. Nailor Industries, Inc.
5. Titus.
6. Tuttle and Bailey.

B. (Type E) Linear Supply Diffuser: 4'-0" long with (2) 1-inch slots, with adjustable vanes for direction control.

1. Fabrication: Steel with finish as indicated on Drawings.
2. Frame: 1-1/4 inch margin with support clips for T-bar mounting and end cap. Provide sheet rock frame where indicated on Drawings.
3. Plenum: Integral, galvanized steel, insulated.

C. (Type H) Linear Return Diffuser: 4'-0" long with (2) 1-inch slots.

1. Fabrication: Steel with finish as indicated on Drawings.
2. Frame: 1-1/4 inch margin with support clips for T-bar mounting and end cap.

2.5 ROUND CEILING DIFFUSERS

A. Manufacturers:

1. E. H Price Company.
2. Krueger.
3. Nailor Industries, Inc.
4. Titus.
5. Tuttle and Bailey.

B. (Type F) Round Diffuser:

1. Product Description: Type: Round, fixed-pattern, stamped, cone-type diffuser to discharge air in 360-degree pattern.

2. Fabrication: Steel with white baked enamel finish.

2.6 DUCT-MOUNTED SUPPLY REGISTERS/GRILLES

A. Manufacturers:

1. E. H Price Company.

2. Krueger.

3. Nailor Industries, Inc.

4. Titus.

5. Tuttle and Bailey.

B. (Type G) Supply Grille:

1. Type: Double deflection register with individually adjustable bars, for direct mounting to spiral duct.

2. Frame: 1-3/8 inch margin with countersunk screw mounting.

3. Fabrication: Aluminum with factory finish.

4. Mounting: Direct mount to spiral duct. Includes gasket for tight seal.

5. Finish: As indicated on Drawings.

6. Damper: Air scoop type, aluminum, operable from face with screwdriver.

2.7 HEAVY DUTY GYM GRILLE

A. Manufacturers:

1. E. H Price Company.

2. Krueger.

3. Nailor Industries, Inc.

4. Titus.

5. Tuttle and Bailey.

B. (Type I) Return Grille:

1. Type: Heavy-duty louvered face grille for gymnasium and athletic applications.

2. Frame: 1-1/4 inch margin with countersunk screw mounting.

3. Fabrication: Heavy-gauge steel.

4. Finish: As indicated on Drawings.

2.8 LOUVERS (ICC-500 STORM SHELTER RATED)

A. Manufacturers:

1. Greenheck (Basis of Design: AFL-501)

2. Ruskin (provide ICC-500 equivalent)

3. Pottorff (provide ICC-500 equivalent)

4. United Enertech (provide ICC-500 equivalent)

B. Product Description:

1. Stationary, wind-driven rain resistant louver specifically tested and rated for tornado storm shelter applications in accordance with ICC 500.

C. Performance Requirements:

1. Comply with ICC 500 for windstorm and windborne debris impact resistance.

2. Louver assembly (including blades, frame, and accessories) shall be tested for missile impact and remain functional after impact.

3. Provide louver capable of withstanding minimum 250 mph wind loads (or as required by project shelter designation).

4. Certified wind-driven rain performance per AMCA Publication 550 and 540.

5. Maximum free area velocity and pressure drop shall be scheduled on drawings.

D. Construction:

1. Depth: 5 inches nominal.

2. Blade Design: Horizontal drainable blades with vertical sight-proof configuration.

3. Frame: Heavy gauge, reinforced frame designed for impact resistance and anchorage to structure.

4. Mullions: Manufacturer’s standard for large openings, designed to maintain ICC 500 compliance.

5. Fabrication: Welded aluminum construction with internal bracing as required to meet impact criteria.

E. Materials:

1. Aluminum construction, minimum thickness as required to meet ICC 500 missile impact requirements (heavier than standard architectural louvers).

2. Fasteners and reinforcement components as required for tested assembly compliance.

F. Finish:

1. Factory-applied fluoropolymer coating (70% PVDF) or anodized finish.

2. Color as selected by Architect.

G. Accessories:

1. Bird Screen: Heavy-duty, minimum 1/2-inch mesh, mounted on interior and designed not to compromise ICC 500 compliance.

2. Insect Screen: Not permitted where it reduces airflow or compromises debris impact rating.

3. Extended sill or drain pan where required for water management.

4. Installation hardware and anchorage system as tested with the louver assembly.

H. Installation Requirements:

1. Install in accordance with manufacturer's ICC 500 tested installation details.

2. Anchorage into structure shall be designed to transfer impact and wind loads without failure.

3. Coordinate with structural drawings for reinforced openings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify inlet and outlet locations.

B. Verify ceiling and wall systems are ready for installation.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 33 00.

C. Paint visible portion of ductwork behind air outlets and inlets matte black.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 38 13 - COMMERCIAL-KITCHEN HOODS & EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type 1 grease exhaust hoods for commercial kitchen applications.
2. Wet chemical fire suppression systems for commercial kitchen hood protection.
3. Fire-ready range hoods (residential-style) for domestic ranges in commercial environments, with factory-installed UL 300A listed fire suppression.
4. Utility distribution system (UDS) providing centralized gas, domestic hot and cold water, and electrical services to commercial cooking equipment.

B. Related Sections:

1. Section 23 34 00 - HVAC Fans: Exhaust fans serving commercial kitchen hoods.
2. Section 23 31 00 - HVAC Ducts and Casings: Grease exhaust ductwork serving kitchen hoods.
3. Section 23 09 00 - Instrumentation and Control for HVAC: Hood control system integration with building automation.
4. Section 26 05 03 - Equipment Wiring Connections: Execution and product requirements for electrical connections to UDS and cooking equipment.

1.2 REFERENCES

A. National Fire Protection Association:

1. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

B. Underwriters Laboratories Inc.:

1. UL 300 - Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment.
2. UL 710 - Standard for Exhaust Hoods for Commercial Cooking Equipment.
3. UL 891 - Standard for Dead-Front Switchboards.

C. NSF International:

1. NSF/ANSI 2 - Food Equipment.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section unless otherwise noted.

B. Commercial kitchen exhaust hoods shall be Type 1 UL 710 listed grease hoods designed to capture grease, smoke, and vapors from cooking equipment located below.

C. Wet chemical fire suppression systems shall be UL 300 listed and installed in accordance with NFPA 96 by an authorized service agent.

D. The utility distribution system shall provide centralized utility services including gas, domestic hot and cold water, and electrical distribution from single-point overhead connections to individual cooking appliances below.

1.4 SUBMITTALS

A. Shop Drawings: Submit fabrication drawings for each hood indicating dimensions, materials, exhaust collar locations and sizes, filter quantities and sizes, lighting layout, supply air plenum configuration, mounting and hanger bracket details, ceiling enclosure dimensions, and section joint locations.

B. Shop Drawings - Utility Distribution System: Submit fabrication drawings indicating UDS dimensions, plan view, end elevations, utility service schedule, cooking equipment connection schedule, field joint locations, and wiring diagrams.

C. Product Data: Submit manufacturer's product data for each product, including:

1. Hood construction, materials, UL listing information, filter type, and lighting data.

2. Fire suppression system design parameters, agent type, nozzle layout, coverage diagram, and UL 300 listing information.

3. Utility distribution system component data, service capacities, panelboard schedule, and UL 891 listing information.

D. Coordination Drawings: Coordinate hood locations with ceiling structure, ductwork routing, fire suppression piping, and UDS riser penetrations. Provide approved and signed drawings to hood fabricator prior to fabrication.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit manufacturer's operation and maintenance manuals for hoods, fire suppression system, and utility distribution system.

B. Fire Suppression System Inspection Reports: Submit inspection and acceptance test reports from the authorized fire suppression service agent.

C. Test and Balance Reports: Submit exhaust and supply airflow test and balance reports demonstrating hood performance in accordance with design airflow quantities.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction (AHJ).

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five years of documented experience.

C. Installer Qualifications:

1. Hood and UDS Installation: Food equipment contractor experienced in the installation of commercial kitchen ventilation systems.

2. Fire Suppression System: Installation and commissioning by an authorized service agent in accordance with the system manufacturer's requirements, NFPA 96, and local AHJ requirements.

D. Regulatory Compliance: All products and installation shall comply with NFPA 96, UL 710, UL 300, UL 891, NSF/ANSI 2, and all applicable local codes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hoods and UDS sections in manufacturer's original packaging, protected from damage.

B. Store hoods and UDS sections in an upright position, protected from weather and construction debris.

C. Do not install damaged products. Report shipping damage to the manufacturer immediately.

1.8 FIELD MEASUREMENTS

A. Verify field dimensions prior to hood and UDS fabrication. Provide approved and signed fabrication drawings to manufacturer prior to release for fabrication.

1.9 COORDINATION

A. Coordinate hood and UDS installation with the food equipment contractor, structural contractor, plumbing contractor, and electrical contractor prior to fabrication and installation.

B. Coordinate UDS installation with the plumbing contractor for single-point utility service connections at each riser and with the electrical contractor for main electrical service feeder connections.

C. Coordinate fire suppression system piping connections from UDS risers to hood distribution nozzles with the fire suppression contractor.

D. Coordinate exhaust fan control wiring from UDS controls riser to fan control center with the electrical contractor.

E. Coordinate hood heat sensor and fire suppression interlock wiring with the controls contractor.

PART 2 PRODUCTS

2.1 TYPE 1 EXHAUST HOODS

A. Manufacturers:

1. Basis of Design: Greenheck Fan Corporation; Model GXEW Series, or approved equal.

2. Accurex Engineered Restaurant Systems (a Greenheck company).

3. Captive-Aire Systems, Inc.

4. Halton Company.

B. Hood Type: Type 1, single-wall, exhaust-only wall canopy with integral air curtain supply plenum.

C. UL Listing: UL 710 listed without exhaust fire damper.

D. Materials and Construction:

1. Exposed surfaces: 430 stainless steel, No. 4 finish.

2. Standing seam construction for structural rigidity.

3. Insulated top: Listed for zero clearance to combustibles.

4. Integral factory-mounted air space on back, minimum 3 inches wide.

5. Performance Enhancing Lip (PEL): Factory installed.

6. Continuous capture: UL listed connection for joining multiple hood sections.

7. Provide ceiling enclosure panels on all exposed sides, 18 inches high, to match hood finish.

8. Hood end conditions: Coordinate combustible clearances with building construction. Provide built-in rear stand-off; verify that no wood elements are within 18 inches of hood back, top, and sides. Where wood elements are present, provide UL-listed zero-clearance insulation as required.

E. Grease Filters:

1. Stainless steel X-Tractor type high-efficiency filters with integral spark arrestor.

2. Self-draining, UL listed, removable filter assembly with grease collection cup and concealed grease trough the full length of the hood, pitched to a grease collection pan.

F. Lighting:

1. UL listed recessed LED light fixtures, suitable for use in grease hoods.

2. Provide minimum 70 foot-candles of illumination on the cooking surface below the hood.

G. Supply Air Plenum:

1. Provide factory-mounted air curtain supply (ASP) plenum(s) on hood front face.

2. Supply air collars: Rectangular, factory mounted, as required to connect supply ductwork. Sizes and locations as indicated on the Drawings.

H. Mounting:

1. Mount bottom of hood at 80 inches above finished floor unless noted otherwise on Drawings. Hood shall not be mounted lower than 78 inches or higher than 84 inches above finished floor.

2. Provide factory-installed pre-drilled mounting and hanger brackets. Coordinate hanger rod locations with structural contractor.

3. In seismic areas, obtain approval of installation method from structural engineer.

4. Trim from top of hood to finished ceiling with material to match hood finish using concealed fasteners.

I. Performance:

1. Exhaust volumes, supply volumes, and exhaust rates as indicated on the Drawings and in accordance with NFPA 96 for heavy-duty cooking equipment applications.

2. Commission hood system and provide test and balance report verifying exhaust and supply airflow performance for each hood. If AHJ requires a smoke capture test, the food equipment contractor and HVAC contractor shall jointly perform the test and adjust settings until the test is passed.

2.2 FIRE-READY RANGE HOODS (RESIDENTIAL-STYLE)

A. Manufacturers:

1. Basis of Design: Greenheck Fan Corporation; Model GRRS, or approved equal.

2. Approved equals must be ICC evaluated and certified as compliant with IMC, IFC, and UMC, and must include factory-installed UL Subject 300A listed fire suppression.

B. Application: Exhaust-only wall-canopy hood for covering a domestic range (30 inch or 36 inch wide) installed in a commercial environment for domestic cooking purposes only.

C. Listing: Hood shall be ICC evaluated and certified as compliant with the International Mechanical Code (IMC), International Fire Code (IFC), and Uniform Mechanical Code (UMC). Hood manufacturer shall provide, upon request, documentation confirming compliance with listed code authorities.

D. Construction:

1. 18-gauge minimum, 300 series stainless steel outer shell.

2. Hood shell fabricated with no visible outer welds or weld marks. All internal seams sealed with NSF-approved caulk.

3. Wall-mount configuration; supplied with factory wall mounting bracket.

4. Metal mesh grease filter.

5. Two (2) recessed 2200-2700K color LED lights providing minimum 50 foot-candles of evenly dispersed illumination on the range below.

E. Factory-Installed Fire Suppression System:

1. Hood shall include factory-installed fire suppression system, UL listed to UL Subject 300A, with fully monitored electronic detection and actuation. No braided cable or fusible links shall be accepted.

2. Detection: Two (2) metal-housed temperature sensors monitor the cooking surface and transmit a signal to the main fire system control board upon reaching set-point, activating the tank solenoid valve and discharging wet chemical agent from a pre-charged tank.

3. Tank pressure shall be continuously monitored via tank pressure sensor. A fault shall be displayed on the user interface if low pressure is detected.

4. All fire suppression and control components shall be fully accessible by dropping the hood into a service position without removing the hood from the wall. Latches shall retain the hood in the operating position. No thumb screws or removable hardware are acceptable.

5. Provide dry contacts as standard for integration with building fire alarm system and supply fan controls.

F. Range Disconnect Device:

1. Hood system shall include an electronic or gas shut-off device field-connected to the hood via factory-provided plug-and-play cables. The shut-off device shall disable the range upon detecting high temperature, prior to fire suppression system discharge.

2. Gas Disconnect (where applicable): 3/4-inch gas valve with plug-and-play cable and 115VAC control receptacle.

3. Electric Disconnect (where applicable): 4-prong, 250VAC, 50-ampere power receptacle. Other receptacle types available upon request.

G. User Interface:

1. Provide full-color 4.3-inch LCD touch screen user interface to control fan, range disconnect, and lights, and to display system statuses including faults and alarms. No toggle switches or rheostats are acceptable.

2. All factory and configuration settings shall be accessed via touch screen through password-protected entry.

3. For ADA compliance, user interface may be shipped loose for field mounting on a wall near the hood, with factory-supplied plug-and-play cable.

H. Fan Configuration: Provide one of the following as indicated on the Drawings:

1. Integral Front-Recirculating Fan: Includes accessible charcoal filter and front-discharge opening for filtering exhaust air before returning to the space. For applications where ductwork to exterior is not feasible.

2. Integral Rear-Discharge Fan: Directs exhaust air to exit the back of the hood and discharge through a wall to the exterior.

3. External Fan (Factory-Provided Inline): Factory-provided inline fan with plug-and-play cable; hood configured for top discharge to roof or wall.

4. Fan by Others: Top-discharge hood configuration; fan provided and installed under another section. Coordinate fan selection and duct connection with hood manufacturer.

5. All factory-provided fan options shall include energy-efficient electronically commutated motors (ECM). If fan is provided, unit shall be UL 507 listed or equivalent.

I. NFPA 101 Compliance Option (where required by AHJ):

1. Where NFPA 101 life safety code compliance is required, provide the following:

2. 500 CFM minimum exhaust fan.

3. Locked (password-protected) appliance disconnect with timed automatic range deactivation.

4. Manual pull station with factory plug-and-play cable.

J. System Operation:

1. User interface controls fan speed, lights, and range disconnect on/off.

2. Upon reaching a first temperature set-point, exhaust fan shall engage automatically (if not already on) at a speed corresponding to the detected temperature range.

3. Upon reaching a second, higher temperature set-point, the range disconnect shall automatically shut off and a warning shall appear on the user interface.

4. Upon reaching fire suppression activation temperature, the fire suppression system shall discharge wet chemical agent over the range.

2.3 HOOD CONTROLS

A. Provide automated hood control system integrated with exhaust fans and supply air system:

1. Heat Sensors: Automatic detection of cooking activity via heat sensors installed in the filter plenum or exhaust duct collar. Upon detection, controls shall start the hood exhaust fan and supply air system.

2. System Interlock: Controls shall prove supply air operation prior to starting exhaust fan. During fire suppression system activation, supply air system shall shut down and exhaust fans shall remain energized.

3. Gas Valve Interlock: Interconnect hood controls with UDS electric gas shut-off valve.

4. Control Panel: Provide LED display panel with system status indication. Locate control panel on or remote from UDS as indicated on the Drawings.

B. Control Modes - Provide one of the following as indicated on the Drawings:

1. Constant Volume: Hood exhaust fan operates at 100 percent of design airflow during occupied periods.

2. Variable Volume (Demand-Controlled Kitchen Ventilation, DCKV): Provide sensors and/or optics to detect heat and smoke. Hood exhaust volume shall modulate between minimum and maximum settings in proportion to actual cooking activity. Coordinate variable-speed drive control signal with exhaust fan specification.

2.4 FIRE SUPPRESSION SYSTEM

A. System Type: Pre-engineered wet chemical fire suppression system, UL 300 listed.

B. Acceptable Systems:

1. Ansul R-102 (Johnson Controls).

2. Amerex KP Series.

3. Kidde Kitchen Knight II.

4. Or approved equal per AHJ.

C. Agent: Low-pH liquid wet chemical agent. System shall be listed and approved for use over fryers, griddles, range tops, broilers, char-broilers, and wok cooking equipment.

D. Components:

1. Cabinet to house chemical agent tanks, activation controls, and alarm dry contacts.

2. Distribution piping: Schedule 40 black iron pipe and fittings. Chrome-plated pipe and fittings at all exposed locations.

3. Hood temperature fusible-link or heat detector devices installed in filter plenum.

E. Coverage: Provide fire suppression nozzle coverage for each of the following areas:

1. All cooking equipment located under each exhaust hood.

2. Filter plenum of each hood section.

3. Exhaust duct collar of each hood section.

F. Service Controls:

1. Provide dry contacts to activate the building fire alarm system upon system discharge.

2. Provide electric gas shut-off valve on UDS (furnished by UDS manufacturer) with manual reset station. Gas shut-off valve shall close upon system activation and shall require manual reset before gas service is restored.

3. Provide electric shunt-trip signal to electrical panel upon system activation where required.

G. Installation: Install by an authorized service agent in accordance with manufacturer's requirements, NFPA 96, and local AHJ requirements. Commissioning and acceptance testing by authorized service agent.

2.5 UTILITY DISTRIBUTION SYSTEM (UDS)

A. Manufacturers:

1. Basis of Design: Greenheck Fan Corporation; Model MIV-GHC Series, or approved equal.

2. Accurex Engineered Restaurant Systems (a Greenheck company); FlexConnect Series.

3. Captive-Aire Systems, Inc.

B. Listing: UL/ULC 891 Listed.

C. Construction:

1. Island- or wall-type configuration as indicated on the Drawings.

2. Service risers and horizontal distribution chase: 16-gauge, Type 300 series stainless steel with removable access panels on both sides.

3. Horizontal chase divided into separate, fully isolated compartments for plumbing and electrical services.

4. Full-length bumper guards on both sides of chase at cooking equipment level.

5. Flanged stainless steel foot pedestals at each field joint on horizontal chase.

6. Weatherproof receptacle covers for all electrical and plumbing connections.

7. Riser convenience receptacle (120V/1-phase, 20A) at both service riser ends.

8. Status indicator lights for each electrical circuit, minimum 12 total.

9. Field joints: Number-matched connections folded back for shipment; field-jointed chase with staggered threaded unions for accessibility.

D. Plumbing Services:

1. All plumbing shall have single-point connection in the plumbing riser, piped from the ceiling by the plumbing contractor.

2. Gas Manifold: 2-inch looped gas manifold (7 inches W.C. operating pressure, 0.30 inches W.C. maximum pressure drop) with welded thread-o-let connections. Gas connections spaced 12 inches apart, alternately sized 3/4 inch and 1-1/4 inch. Provide main quarter-turn ball valve shut-off and factory-installed electrical solenoid gas valve for fire suppression shutdown. All unused gas drops capped below chase.

3. Gas Emergency Control Station: Provide at end of UDS service riser with gas-on pilot light, gas reset button, emergency stop button, and gas-off alarm.

4. Hot and Cold Water Manifolds: 1-inch hot water and 1-inch cold water manifolds with 3/4-inch plumbing drops at 24-inch centers along horizontal chase. Insulate and label all water piping. Provide main quarter-turn ball valve shut-offs and pressure gauges on each manifold. Provide ball valves and flexible stainless steel braided hoses for all cooking equipment connections. All unused plumbing drops capped below chase.

5. Filtered water supply, if required by cooking equipment: Rated for minimum 5 gallons per minute, provided in the plumbing riser with manifold piping to appliances.

E. Electrical Services:

1. Electrical compartment shall be completely enclosed and separated from the plumbing compartment.

2. Provide 120/208V, 3-phase panelboard-style electrical service with all circuit breakers end-mounted behind a dead-front with hinged door access. Main breaker: 250 amperes with shunt trip, or 20 percent above calculated connected load, whichever is greater.

3. Status indicator lights for each individual circuit breaker.

4. Provide receptacle plates on 12-inch centers beneath the horizontal chase. Provide plug/cord sets to match electrical connections for all cooking appliances unless hard-wired.

5. All 120-volt, 20-ampere connections: Duplex GFCI receptacles. Provide weatherproof covers.

6. Light and fan toggle control switches: Provide at end of electrical service riser.

7. Fire suppression switch connection (C, NO, NC, 120V/1-phase): Wiring from UDS riser to fire suppression control panel by electrical contractor.

8. UDS controls power input: 120V/1-phase, 15-ampere minimum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation, verify that rough-in dimensions, utility connection locations, ceiling heights, structural support conditions, and clearances to combustibles are correct and in accordance with approved shop drawings and NFPA 96.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION - EXHAUST HOODS

A. Install hoods in accordance with manufacturer's instructions, approved shop drawings, NFPA 96, and local AHJ requirements.

B. Verify combustible clearances before installation. Coordinate with building contractor. Install UL-listed zero-clearance insulation where required.

C. Mount at height indicated on the Drawings. Mount no lower than 78 inches above finished floor.

D. Silicone seal all joints between hood sections and between hood and UDS risers.

E. Connect supply air plenum collars to supply ductwork. Connect exhaust collars to grease exhaust ductwork.

F. Replace all access panels removed during installation.

3.3 INSTALLATION - FIRE SUPPRESSION SYSTEM

A. Install by authorized service agent per manufacturer requirements, NFPA 96, and local AHJ.

B. Connect fire suppression distribution piping from UDS risers through hood to nozzles in accordance with system design drawings.

C. Connect system dry contacts to building fire alarm system and to UDS electric gas shut-off valve.

D. Perform commissioning and acceptance testing. Submit inspection report.

E. Provide 6-month and 1-year site inspection visits during the project warranty period.

3.4 INSTALLATION - UTILITY DISTRIBUTION SYSTEM

A. Deliver, field-assemble, and install UDS in accordance with approved fabrication drawings and manufacturer's instructions.

B. Coordinate penetration of UDS risers into hoods. Silicone seal all resulting joints.

C. Plumbing Contractor Responsibilities:

1. Provide and install main supply piping and fittings to UDS risers in accordance with main service schedule on approved shop drawings.

2. Connect fire suppression piping (as required) from UDS riser to hood.

3. Inspect and tighten all joints and fittings prior to start-up.

4. Replace all access panels removed during installation.

D. Electrical Contractor Responsibilities:

1. Furnish and install electrical service feeders and overcurrent protection devices to UDS electrical riser in compliance with NEC and applicable codes. Electrical panel requires minimum 3-foot working clearance per NEC.

2. Make electrical service connections to power lugs or distribution block in UDS riser.

3. Provide 3-wire, 120V circuit from hood light terminals in UDS riser to light junction box on hood.

4. Provide 3-wire, 120V circuit from UDS riser terminals to fire suppression system micro-switch or dry contacts in fire suppression control panel.

5. Install cord sets and/or pre-wired flexible conduit from distribution chase to cooking appliances in accordance with cooking equipment connection schedule. Final cord set connections to cooking equipment by electrical contractor.

6. Inspect and secure all connections loosened during shipment and installation. Replace all access panels removed during installation.

E. Restore all number-matched field joint connections when bringing UDS sections together on site.

3.5 FIELD QUALITY CONTROL

A. Hood Test and Balance: Commission hood system and provide test and balance report verifying exhaust and supply airflow for each hood. Balance report shall include supply air readings for each supply air plenum. If AHJ requires a smoke capture test, food equipment contractor and HVAC contractor shall perform test jointly and adjust settings until test is passed.

B. UDS Start-Up: Inspect all utility connections. Verify gas valve operation and emergency stop function. Test fire suppression switch circuit continuity. Verify all electrical connections are secure prior to energizing.

C. Provide Owner with operation and maintenance manuals and all documentation shipped with hoods and UDS.

END OF SECTION

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SECTION 23 40 00 - HVAC AIR PURIFICATION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

1.2 REFERENCED CODES AND STANDARDS

A. The following codes and standards are referenced through-out. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1. ASHRAE Standards 62 & 52
2. National Electric Code NFPA 70
3. UL 867-2007 including ozone chamber test required as of December 21, 2007
4. UL 2998 Environment – No Ozone Certification
5. The cold plasma equipment and power supply shall be UL listed.
6. ASHRAE 62 now requires all electronic air cleaners to be UL 2998 certified as an ozone free device. Products without UL 2998 shall not be acceptable.

1.3 RELATED WORK

A. Testing, Adjusting and Balancing
B. Facility Access and Protection
C. Ductwork
D. Filters
E. Water and Refrigerant Piping
F. Electrical Wiring
G. Control Wiring

1.4 QUALITY AND IP ASSURANCE

A. Basis of design is Global Plasma Solutions. Products include: GPS-FC48-AC; GPS-DM48-AC; GPS-iMOD; GPS-iRIB or GPS-FC-3-BAS. All other manufacturers requesting prior approval must submit product drawings, specifications and test results specified in Section 2.2 at least one week prior to bid date.

B. The Air Purification System shall be a product of an established manufacturer within the USA. Direct Current (DC) Ion modules manufactured outside the USA and assembled in the USA on mounting plates or formed channels shall not be acceptable.

C. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

D. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable. Any system containing titanium dioxide (Ti02), which has been listed by the CDC as a known carcinogen, shall not be acceptable.

E. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2019

to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations. The data shall be based on the manufacturer's use of the same make and model number as the equipment submitted on this project.

F. The Air Purification Technology shall have been tested by UL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved UL 867 prior to December 21, 2007 and have not been tested in accordance with the newest UL 867 standard with the ozone amendment shall not be acceptable. All manufacturers requesting prior approval shall submit their independent UL 867 test data with ozone results to the engineer for preliminary review and during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.

G. The maximum allowable ozone concentration per the UL 2998 chamber test shall be 5 PPB. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.

H. All manufacturers shall have their product tested to UL 2998 Environmental Standard for confirmation of no ozone with certificate available. The final report shall indicate the ozone levels and high voltage output the device's electrode(s) were operating during the test. Reports that do not include high voltage output during the UL 2998 testing shall not be acceptable.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
2. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.
3. Performance data for each type of plasma device furnished.
4. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air Scheduled (when projects are designed with outside air reduction).
5. Product drawings detailing all physical, electrical and control requirements.
6. Copy of UL 867 independent ozone test.
7. Copy of UL 2998 conformance certificate.
8. Statement on the manufacturer's letterhead stating that the technology contains no titanium dioxide (Ti02).

B. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.

B. Store in original cartons and protect from weather and construction work traffic.

C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.7 WARRANTY

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of eighteen months after shipment or twelve months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturer specified.

B. Basis of Design: Global Plasma Solutions
   1. Ionization Bars: GPS-iMOD

C. All other Suppliers of comparable products requesting prior approval shall:
   1. Submit for prior approval one week in advance in accordance with the product substitution requirements.
   2. In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2019 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third-party validation study performed on a previous installation of the same application using the same make and model equipment shall also be included.
   3. Submit independent test data from UL showing ozone levels produced during the UL 867 ozone chamber test. Manufacturers without this test data shall not be acceptable.

2.2 BI-POLAR IONIZATION DESIGN AND PERFORMANCE CRITERIA

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.

B. The Bi-polar Ionization system shall be capable of:
   1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
   2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
   3. Capable of reducing static space charges.
   4. Effectively reducing space particle counts.
   5. Producing a minimum of the following ions/cm^3 at the ion generator:
      a. GPS-FC48-AC: > 400M ions/cm^3/sec
      b. GPS-FC-3-BAS: > 350M ions/cm^3/sec
      c. GPS-iMOD: > 140M ions/cm^3/sec per inch of bar
      d. GPS-iRIB: > 35M ions/cm^3/sec per foot
   6. Increasing the interior ion levels, both positive and negative, to a minimum of 1,000 ions/cm^3 measured 5 feet from the floor.
   7. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.
   8. Self-cleaning requiring no maintenance or replacement parts.

9. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:
   A. MRSA - >96% in 30 minutes or less
   B. E.coli - > 99% in 15 minutes or less
   C. TB - > 69% in 60 minutes or less
   D. C. diff - >86% in 30 minutes or less
   E. Noro Virus -> 93.5% in 30 minutes or less
   F. Legionella -> 99.7% in 30 minutes or less

   Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELAP accredited independent lab confirming kill rates and time meeting the minimum requirements stated in section 2.2 B, points 6A, 6B and 6C. Products tested only on Petri dishes to prove kill rates shall not be acceptable. Products being sold under different trade names than those tested shall not be acceptable.
10. Capable of modular field assembly in six inch (150mm) sections.

C. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable. Ionizers with positive and negative output (DC type) shall not be acceptable. All ionizers provided shall be AC type ionizers with one electrode pulsing between positive and negative.
   1. Air exchange rates may vary through the full operating range of a constant Volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
   2. Velocity Profile: The air purification device shall not have maximum velocity profile.

D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.

E. Equipment Requirements:
   1. Electrode Specifications (Bi-polar Ionization):
      a. Each alternating current (AC) Ionization Bar with Bi-polar Ionization output shall include a minimum of eighteen carbon fiber cluster ion needles per foot of coil face width shall be provided. The entire cooling coil width shall have equal distribution of ionization across the face. Systems without ion needles at least 0.50" (12.5mm) apart shall not be acceptable. The plasma electrode shall require no more than 1.0" (25mm) in the direction of airflow for mounting. All hardware required for mounting shall be provided by the air purification manufacturer except self-tapping screws for the power supply. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, and performance output reduction over time, ozone production and corrosion.
      b. Electrodes shall be provided in 6.0" (150mm) increments, epoxy filled for an IP55 rating and utilizing brass connection hardware that is recessed into the connection joint once fully engaged and assembled.
      c. Electrodes shall be energized when the main unit disconnect is turned on.

d. The ionization output shall be a minimum of 60 million ions/cc per inch of cooling coil width as measured 1 inch from the cold plasma needles.
e. Ionization bars shall be provided with magnet mounting kits to prevent penetration into cooling coils.
f. Ionization bars shall be constructed of UL 94VO and UL746C composite material.
g. If the ionization bars are mounted immediately downstream from a humidifier, protective rain covers shall be provided over the ionization bars by the installing contractor. The design of the cover shall be confirmed with the ionization manufacturer prior to installation.

2. Electrode Specifications (Bi-polar Ionization):
a. Each Plasma Generator with Bi-polar Ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity. A minimum of one electrode pair per 4,800 CFM of air flow shall be provided. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.
b. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating. Electrodes shall be made from carbon fiber to prevent oxidation over time. Internal circuitry shall be provided to sense air flow across the electrode output. Ionization systems requiring the use of a mechanical air pressure switch to cycle the electrodes only when the fan is operating shall not be acceptable due to high failure rates and pressure sensitivity.
c. Electrode pair shall provide a minimum of 200 million ions per cubic centimeter as measured at 2 inches, both positive and negative ions, in equal quantities. Devices providing less than 200 million ions/cc per electrode pair shall not be acceptable.
d. Each Plasma Generator shall be provided with a self-cleaning system that is field programmable to change the number of days between the cleaning cycle. Systems without a no-maintenance, self-cleaning system shall not be acceptable.
e. Each electrode pair shall be designed with a banana style plug such that it can be field replaced if necessary.
f. Each Plasma Generator shall be provided with an inline on/off switch, universal voltage input (24VAC to 240VAC or DC), magnets for mounting to the fan inlet, replaceable carbon fiber emitters and a programmable self-cleaning system.

F. Air Handler & Plenum Mounted Units (non-ductless mini-split units):
1. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and wire it to the AHU control power (24VAC) as instructed by the Air Purification Manufacturer's instructions or line voltage subject to power available. Each unit shall be designed with a molded casing, self-cleaning system, self-cleaning test button, power status LED and dry contacts to prove ion output is operating properly. The dry contacts shall close to prove the ion generator is working properly and may be daisy chained in series such that only one dry contact per AHU is required to interface to the BAS or the optional DDC controller. Dry contacts proving power has been applied in

lieu of the ion output is actually operating, are not acceptable. Manufacturers providing multiple ion modules that have alarm status wired in parallel, and not in series, shall not be acceptable.

G. Air Handler Mounted Units:
1. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and wire it to the remote mount power supply using the cables provided by the air purification manufacturer. A 24VAC, 115VAC or 208-230VAC circuit shall be provided to the plasma generator power supply panel. No more than 15 watts shall be required per power supply. Each power supply shall be capable of powering up to 6 ionization bars or a total of 50 linear feet of bar(s). Each plasma generator shall be designed with fiberglass housing, liquid tight flexible conduit and a high voltage quick connector.
2. Where the ionization bars are mounted downstream of steam humidifiers, the air handler manufacturer shall provide an angled hat section that will cover the ionization bars and deflect any direct condensation towards the floor and off the bars.

H. Plasma Requirements:
1. Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.
   a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 24VAC, 115VAC or 208-230VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.
   b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced (AC Ionizers only are acceptable). Imbalanced levels shall not be acceptable.
   c. Ionization output from each bar shall be a minimum of 120 million ions/cc per inch of bar when tested at 1" from the ionization bar. Bars with needles spaced further apart than 0.5" shall not be acceptable.
   d. Each plasma electrode shall be made from an all fiberglass composite, UL 94V0 and UL 746C rated material for prevention of corrosion and electrical insulation.
2. Ozone Generation:
   a. The operation of the electrodes or Bi-polar ionization units shall conform to UL 2998 as tested by UL proving no ozone output.

I. Electrical Requirements:
1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 24VAC, 115 VAC or 208-230VAC, 1 phase, 50/60 Hz. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

J. Control Requirements:
1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset. Systems requiring fuses shall not be acceptable.
2. The Plasma Generator power supply shall have internal circuitry to sense the ionization output and provide dry contact alarm status to the BMS as well as a local "Plasma On" indication light.

3. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.

K. Air Ion Measuring Device:

1. Installing contractor shall provide one (1) hand-held air ion counter, AlphaLab Inc. Model AIC 2M, 2 Million model (or approved equal) with offset/output jack cable and AC power supply. Device is to be left with Owner following installation.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.2 ASSEMBLY & ERECTION: PLASMA GENERATOR

A. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.

B. Any material damaged by handling, water or moisture shall be replaced by the mechanical contractor, at no cost to the owner.

C. All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.3 TESTING

A. Provide the manufacturers recommended electrical tests.

3.4 COMMISSIONING & TRAINING

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

B. Installing contractor shall provide a record of pre- and post-ion measurements (ions/cm^3) in a representative room for each of the spaces served.

C. Where space ion counts (positive or negative) are below 1,000 ions/cm^3; alert the Owner and engineer of record and assess the reason for the limited ion count in the space.

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SECTION 23 73 00 - INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes modular factory fabricated air-handling units and accessories.

B. Related Sections:
1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors for placement by this section.
2. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.
3. Section 23 07 00 - HVAC Insulation: Product requirements for insulation for placement by this section.
4. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
5. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
6. Section 23 21 13 - Hydronic Piping: Product requirements for chilled water and hot water piping connections to air handling units.
7. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
8. Section 23 33 00 - Air Duct Accessories: Product requirements for flexible duct connections for placement by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air-Conditioning, Heating, & Refrigeration Institute:
1. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
2. AHRI 430 - Central Station Air Handling Units.
3. AHRI 610 - Performance Rating of Central System Humidifiers for Residential Applications.
4. AHRI 1060 – Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

C. Air Movement and Control Association International, Inc.:
1. AMCA 99 - Standards Handbook.
2. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
5. AMCA 500 - Laboratory Methods of Testing Louvers for Rating.

D. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
2. ASHRAE 84 – Method of Testing Air-to-Air Heat/Energy Exchangers.

E. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.

F. National Fire Protection Association:
1. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

G. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

H. Underwriters Laboratories Inc.:
   1. UL 900 - Standard for Air Filter Units.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

B. Product Data, Submit the following:
   1. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
   2. Heat recovery effectiveness.
   3. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
   4. Fans: Performance and fan curves with specified operating point plotted, power, RPM.
   5. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
   6. Dampers: Include leakage, pressure drop, and sample calibration curves. Indicate materials, construction, dimensions, and installation details.
   7. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Outside Air Damper Leakage: Test in accordance with AMCA 500.

C. Heat Recovery Effectiveness Rating: Measure in accordance with AHRI 1060 per ASHRAE 84.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

B. Protect units from weather and construction traffic by storing in dry, roofed location.

1.9 WARRANTY

A. Air handling unit and factory packaged controls shall be warrantied for 18 months from date of shipment.

1.10 EXTRA MATERIALS

A. Furnish one set of filters for each unit.

PART 2 PRODUCTS

2.1 AIR HANDLING UNITS

A. Manufacturers:
   1. AAON, Inc.
   2. Carrier (UTC Building & Industrial Systems).
   3. Daikin Applied (aka McQuay).
   4. Dunham Bush.
   5. Trane (Ingersoll Rand).
   6. York (Johnson Controls, Inc.).

B. Configuration: Fan section plus accessories, including:
   1. Cooling coil section.
   2. Heating coil section.
   3. Energy recovery and preheat section.
   4. Filter section.
   5. Mixing box section.
   6. Inlet and discharge plenums.

C. Performance Base: Sea level pressure or altitude.

D. Fabrication: Conform to AMCA 99 and AHRI 430.

E. Project is based on the specified equipment. Any additional re-engineering or installation costs associated with using alternate manufacturer's equipment shall be borne by the installing contractor.

2.2 CASING

A. Casing sections: Air handling equipment to be provided in sections as required to fit into the mechanical room space. Shipping splits between sections to be assembled with gaskets and bolts.

B. Duct connection locations and sizing: Air handling equipment connection points and sizing to be field measured and confirmed prior to ordering. Contractor is responsible for all sizes and locations coordination.

C. Channel base and drain pan of welded steel. Assemble sections with gaskets and bolts.

D. Leakage Rating: Shall not exceed 0.5 CFM / sq ft of cabinet area at 5 inches of W.C.

E. Outside Casing:
   1. Galvanized Steel: 18-gauge minimum.

F. Inside Casing:
   1. Galvanized Steel: , 20-gauge minimum.

G. Floor Plate:
   1. Galvanized Steel: 14-gauge minimum.

H. Insulation: 2" R-13 foam insulation.

I. Finish: Manufacturers standard on exterior.

J. Access Doors: Galvanized steel insulated sandwich construction, for flush mounting, with hinges, gasket, latch, and handle assemblies, 4.5-inch minimum handle length.
   1. Width: Not less than 16 inches. Fan access doors shall be the minimum width required to remove motor and fan wheel.
   2. Location: Located to allow for periodic maintenance and inspection of fans, dampers, coils, filters, and access sections.
   3. Door Swing:
      a. Upstream of Fan: Outswing.

b. Downstream of Fan: Inswing, or outswing with safety latch to prevent opening under pressure.

K. Drain Pans: Single thickness stainless steel with welded corners. Cross break and pitch to drain connection. Minimum slope 1/4 inch per foot. Furnish drain pans under cooling coil section and mixing section .

L. Strength: Furnish structure to brace casings for suction pressure of 2.5-inch W.C., with maximum deflection of 1 in 200.

2.3 FANS

A. Type: Plenum type fan, direct drive.

B. Performance Ratings: Conform to AMCA 210.

C. Sound Ratings: AMCA 301, tested to AMCA 300.

D. Bearings: Self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of casing with copper tube and grease fitting rigidly attached to casing.

E. Mounting: Locate fan and motor internally on welded steel base coated with corrosion resistant paint. Factory mount motor on slide rails. Furnish access to motor, drive, and bearings through removable casing panels or hinged access doors. Mount base on vibration isolators.

F. Fan Modulation: Variable Frequency Drive. Refer to Section 23 09 00.
1. Variable Frequency Drive provided by Temperature Controls Contractor.

G. Flexible Connection: Separate unit from connecting ductwork.

2.4 FAN ASSEMBLIES

A. Acceptable fanwall assembly shall be a single width, single inlet, class II, direct-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.

B. Acceptable fan array assembly shall consist of a total quantity of 3 single width, single inlet, direct-drive type plenum fans dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. All fan assemblies shall be dynamically balanced by the manufacturer on all three planes.
1. Walk in access section placed downstream for motor access.
2. Unit shall have two 12 blade direct drive class II fans.
3. Manual block-off mounted upstream of fan for isolation of individual fans.
4. Fan array section shall come with sound absorbing panels installed around each fan.

C. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.

2.5 MOTORS

A. Refer to Section 23 05 13 for motor requirements.

2.6 BEARINGS AND DRIVES

A. Bearings: Pillow block type, self-aligning, grease-lubricated [ball bearings, with ABMA 9 L-50 life at 200,000 hours.

B. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

1. **Hollow shafts are NOT acceptable.**

C. Direct Drive: coupling shall directly connect motor to fan wheel.

2.7 COILS

A. Casing with access to coils as shown on plan. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.
   1. Drain and vent connections shall be provided exterior to the unit casing.
   2. Coil connections shall be factory sealed where piping extends through unit casing air tight.

B. Drain Pans: 24 inch downstream of coil and down spouts for cooling coil banks more than one coil high.

C. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.

D. Fabrication:
   1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
   2. Fins: Aluminum.
   3. Casing: Die formed channel frame of galvanized steel.

E. Hydronic Heating Coils:
   1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
   2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.
   3. Casings: Stainless steel.

F. Hydronic Cooling Coils:
   1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
   2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.
   3. Casings: Stainless steel.

2.8 FILTERS

A. Filter Box: Section with filter guides, access doors from both sides, for side loading with gaskets and blank-off plates.

B. Filter Media: UL 900 listed, Class I or Class II, approved by Authority Having Jurisdiction.

C. MERV Rating: Refer to Drawing Schedules.

2.9 DAMPERS

A. Economizer and Mixing Box Dampers: Section with factory mounted outside, return air, and exhaust air dampers of galvanized steel, hollow-core airfoil blades with vinyl bulb edging in galvanized frame, with galvanized steel axles in self-lubricating nylon bearings, in opposed blade arrangement.
   1. Sizing: Dampers shall be sized for both:
      a. 100 percent outside air flow rate, and
      b. 100 percent return air flowrate

B. Outside Air Damper Leakage: Maximum 3.0 cfm per square foot at 1.0 inches W.C. pressure differential.

C. Damper Leakage: Maximum 2 percent at 4-inch W.C. differential pressure when sized for 2000 fpm face velocity.

D. Damper Actuators: Electronic damper actuators for outside air, return air, and exhaust air dampers.
   1. Provided and installed by Temperature Controls Contactor.

2.10 OUTSIDE AIR MEASURING AND MODULATION DEVICE

A. Refer to Section 23 09 00.

2.11 CONTROLS

A. Controls: Refer to Section 23 09 23.

B. Refer to Section 23 09 93 for sequence of operation.

2.12 CAPACITY

A. Refer to Drawing Schedules.

2.13 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: In accordance with Division 26 and the Drawing Schedules:

B. Disconnect Switch: Factory mount on equipment.

2.14 SMOKE DETECTOR

A. Refer to Drawing Schedules. Refer to Division 28.

PART 3 EXECUTION

3.1 INSTALLATION

A. Contractor is responsible to pre-measure field conditions and order air handling equipment broken down to component sizes that fit into mechanical room spaces. Breakdown and field assemble all equipment as required. Any modifications to building elements to accommodate air handling equipment installation is the responsibility of the mechanical contractor unless shown otherwise in the contract documents.

B. Install in accordance with AHRI 430.

C. Install assembled units with vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 48.

D. Install floor mounted units on concrete housekeeping pads at least 3-1/2 inches high and 6 inches wider than unit as indicated on Drawings.

E. Insulate coil headers located outside airflow as specified for piping. Refer to Section 23 07 00.

F. Install condensate piping with trap and route from drain pan to **nearest drain**. Refer to Section 23 21 13.

3.2 INSTALLATION - CHILLED WATER COOLING COIL

A. Make connections to coils with unions or flanges.

B. Connect water supply to leaving airside of coil (counter flow arrangement).

C. Locate water supply at bottom of supply header and return water connection at top.

D. Install water coils to allow draining and install drain connection at low points.

E. Install valves and piping specialties in accordance with details as indicated on Drawings.

F. Install manual air vents at high points complete with shutoff valve. Refer to Section 23 21 13.

3.3 INSTALLATION - HOT WATER HEATING COIL

A. Make connections to coils with unions or flanges.

B. Connect water supply to leaving airside of coil (counter flow arrangement).

C. Locate water supply at bottom of supply header and return water connection at top.

D. Install water coils to allow draining and install drain connection at low points.

E. Install valves and piping specialties in accordance with details as indicated on Drawings.

F. Install manual air vents at high points complete with shutoff valve. Refer to Section 23 21 13.

3.4 MANUFACTURER'S FIELD SERVICES

A. Furnish services of factory-trained representative for start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.5 CLEANING

A. Vacuum clean coils and inside of unit cabinet.

B. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.6 DEMONSTRATION AND TRAINING

A. Demonstrate unit operation and maintenance.

3.7 PROTECTION OF FINISHED WORK

A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

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SECTION 23 75 23 - PACKAGED MAKE-UP AIR UNITS

PART 1 -- GENERAL

1.1 SUMMARY

A. Section Includes:
1. Natural gas-fired make-up air units.
2. Integral controls.

B. Related Sections:
1. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.
2. Section 23 33 00 – Air Duct Accessories.

1.2 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.3 SUBMITTALS

A. Product Data:
1. Airflow and heating capacities.
2. Dimensions.
3. Weights.
4. Rough-in connections and connection requirements.
5. Duct connections.
6. Electrical requirements with electrical characteristics and connection requirements.
7. Controls.
8. Accessories.

B. Manufacturer’s Installation Instructions: Submit assembly, support details, connection requirements and start-up instructions.

C. Manufacturer’s Field Reports: Submit start-up report for each unit.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of controls installed remotely from units.

B. Operation and Maintenance Data: Submit manufacturer’s descriptive literature, operating instructions, installation instructions and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Sound Rating: In accordance with AHRI 270.

C. Outside Air Damper Performance: Test in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept units on-site in original factory packaging. Inspect for damage.

1.8 WARRANTY

A. Provide 1-year warranty on all parts and labor.

B. Provide extended 5-year burner warranty.

PART 2 -- PRODUCTS

2.1 NATURAL GAS-FIRED MAKE-UP AIR UNITS

A. Manufacturers:
1. Greenheck.
2. Captive Aire.
3. Reznor.
4. Rupp.
5. Titan.

B. Product Description: Self-contained, packaged, factory-assembled and wired, including:
1. Cabinet.
2. Supply fan.
3. Electric heating section.
4. Air filters.
5. Controls.
6. Damper.
7. Accessories.

C. Cabinet:
1. Designed for outdoor installation with weatherproof, double-wall construction.
2. Panels: Constructed of G90 galvanized steel with baked enamel finish meeting slat-spray test in accordance with ASTM B117.
3. Furnish gasketed, hinged access doors.
4. Insulation: Factory-applied to exposed vertical and horizontal panels. One-inch thick aluminum foil faced glass fiber with edges protected from erosion.

D. Supply Fan:
1. Double width, double inlet, forward curved centrifugal type.
2. V-belt drive with matched set belts, rated for 125% motor horsepower
3. L-100,000 bearings.
4. Shaft design for maximum operations speed not to exceed 75% of its first critical speed.
5. Tested in accordance with AMCA 210.
6. Motor:
   a. Permanently lubricated with built-in thermal overload protection.
   b. Premium-efficiency.

E. Gas Burner:
1. Fuel: Natural gas.
3. Gas Burner: Direct fire type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot. Require unit fan operation before allowing gas valve to open.

F. Air Filters: 2-inch thick permanent metal filters in metal frames. 25 to 30 percent efficiency based on ASHRAE 52.1

G. Outside Air Hood:
1. Sized for 100% air flow rate.
2. No damper.

H. Controls:
   1. Furnish terminal strip on unit for connection of operating controls to remote panel.
   2. Discharge air temperature sensor.
   3. Staged or modulating gas valve and actuators. See burner requirements.
   4. Inlet air temperature sensor.
   5. Remote Control and Status Panel: Furnish remote panel containing the following control and status indicators:
      a. Heating mode light.
      b. High temperature limit potentiometer (90 F (adj.))
      c. Low temperature limit potentiometer (55 F (adj.))
      d. Room temperature thermostat (remote sensor required)
      e. Dirty filter indicator light.
      f. Fan only operation and indicator light.
   6. VFD by factory for two-speed control, 100% and 50% airflow rates, where indicated in sequence of operation. See sequence of operation for control interface.
   7. 120V/24V smoke detector to be furnished with unit.
   8. Provide air-flow proving contact.
   9. Provide start-stop signal for exhaust fan operation.
      a. Exhaust fan speed modulation.

I. Capacity: As indicated on drawing schedules.

2.2 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: As indicated on Drawing Schedules.

B. Disconnect Switch: By manufacturer.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Verify building systems to be controlled are ready to operate.

B. Verify air handling units and ductwork have been accepted and air filters are in place before installing sensors in air streams.

C. Verify location of thermostats and other exposed control sensors with Drawings before installation.

3.2 INSTALLATION

A. Concrete Base:
   1. Provide concrete pad.

B. Provide steel structure to support unit minimum of 36” above concrete base.

C. Connect units to supply air ductwork with flexible connections. Refer to Section 23 33 00.

D. Install components furnished loose for field-mounting.

E. Install electrical devices furnished loose for field-mounting.

F. Install control wiring between unit and field-installed accessories:
   1. Provide remote temperature sensor suitable for Class 1 Division 2 application (explosion-proof)
   2. Locate remote temperature sensor at 60-inches above the floor.
   3. Factory damper actuator(s).

3.3 INSTALLATION – NATURAL GAS HEATING SECTION

A. Connect natural gas piping in accordance with IFGC.

B. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

C. Install the following piping accessories on natural gas piping connections. Refer to Section 23 11 23:
   1. Shutoff valve.
   2. Dirt leg.
   3. Pressure regulator.

3.4 MANUFACTURER'S FIELD SERVICES

A. Furnish initial start-up and shut-down during first year of operation, including routine servicing and checkout.

3.5 CLEANING

A. Vacuum clean coils and inside of unit cabinet.

B. Install new throwaway filters in units at Substantial Completion.

3.6 DEMONSTRATION

A. Demonstrate complete operation of systems, including Sequence of Operation prior to Date of Substantial Completion.

B. Demonstrate unit maintenance to Owner.

END OF SECTION

SECTION 23 82 16 - AIR COILS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Air coils.
   2. Electric coils.
   3. Finned tube radiation.
   4. Unit heaters.
   5. Cabinet unit heaters.
   6. Fan coil units.
   7. Unit ventilators.
   8. Induction displacement units.
   9. Chilled beam.

B. Related Sections:
   1. Section 23 07 00 - HVAC Insulation: Execution requirements for insulation specified by this section.
   2. Section 23 21 13 - Hydronic Piping: Execution requirements for connection of chilled water, hot water, and drain piping to units specified by this section.
   3. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
   4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connection to units specified by this section.

1.2 REFERENCES

A. Air-Conditioning, Heating, & Refrigeration Institute:
   1. AHRI 440 – Performance Rating of Room Fan-Coils.
   2. AHRI 840 – Standard for Unit Ventilators.

B. Underwriter Laboratories Inc.:
   1. UL 1995 – Heating and Cooling Equipment.

1.3 SYSTEM DESCRIPTION

A. The Mechanical Contractor is responsible for items in this Section.

1.4 SUBMITTALS

A. Shop Drawings: Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers

B. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

B. Operation and Maintenance Data: Submit manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.6 QUALITY ASSURANCE

A. Perform Work in compliance with all applicable codes and standards enforced by the Authority Having Jurisdiction, as well as all applicable laws, ordinances, and regulations.

B. Fan Coil Units: Conform to AHRI 440 and UL 1995.

C. Unit Ventilators: Conform to AHRI 440, AHRI 840, and UL 1995.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept units on site in factory packing. Inspect for damage. Store under roof.

B. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.9 FIELD MEASUREMENTS

A. Induction unit filler panels: Verify room dimensions prior to order and installation.

B. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 AIR COILS

A. Manufacturers:
   1. AAON Coil Products.
   2. Carrier Corporation (United Technologies Corporation).
   3. Dunham-Bush.
   4. McQuay International (Daikin Applied).
   5. Trane, Inc. (Ingersoll-Rand, Inc.).
   6. York International (Johnson Controls, Inc.).

B. Fabrication:
   1. Tubes: 5/8 inch OD seamless copper, arranged in parallel or staggered pattern, expanded into fins, brazed joints.
   2. Fins: Aluminum continuous plate type with full fin collars or individual helical spiral finned tube type wound under tension.
   3. Casing: Die formed channel frame of 16 gage galvanized steel with mounting holes on 3 inch centers. Furnish intermediate center tube supports for plate fin coils longer than 36 inches. Furnish intermediate tube supports for spiral fin coils at manufacturer's recommended intervals to eliminate sagging during operation.

C. Water Heating and Cooling Coils:
   1. Headers: Cast iron with tubes expanded into header, seamless copper tube with silver brazed joints, or prime coated steel pipe with brazed joints.
   2. Leak Testing: Air test under water to 200 psig for working pressure of 200 psig and 200 degrees F.
   3. Configuration: Self draining circuitry, with threaded plugs in headers for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.
   4. Fin Spacing12 fins per inch.

2.2 FINNED TUBE RADIATION

A. Manufacturers:
   1. Rittling (Zehnder Group).
   2. SIGMA Corporation.
   3. Sterling Hydronics (Mestec, Inc.).
   4. Trane, Inc. (Ingersoll-Rand, Inc.).
   5. Vulcan Radiator (Mestec, Inc.).

B. Heating Elements: Seamless copper tubing, mechanically expanded into evenly spaced aluminum fins, suitable for soldered fittings.
   1. Tubing and fin to be sized to meet required capacity per Drawings.

C. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

D. Enclosures: 0.0478 inch thick steel up to 18 inches in height, 0.598 inch steel over 18 inches in height, with easily jointed components for wall to wall installation. Support rigidly, on wall or floor mounted brackets [at least 3 feet on center maximum].
   1. Style: Refer to Drawing Schedules.

E. Finish: Factory applied baked enamel. Coordinate with Architect for color.

F. Access Doors: For otherwise inaccessible valves, furnish factory-made permanently hinged access doors, 6 x 7 inch minimum size, integral with cabinet.

G. Capacity: Refer to Drawings, based on 65 degrees F entering air temperature, 145 degrees F average water temperature.

2.3 UNIT HEATERS

A. Manufacturers:
   1. Modine Manufacturing Company.
   2. Reznor (Nortek, Inc.).
   3. SIGMA Corporation.
   4. Sterling Hydronics (Mestec, Inc.).
   5. Trane, Inc. (Ingersoll-Rand, Inc.).
   6. Vulcan Radiator (Mestec, Inc.).

B. Coils: Seamless copper tubing, 0.025 inch minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Casing: 0.0478-inch thick steel with threaded pipe connections for hanger rods.

D. Finish: Factory applied baked enamel.

E. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

F. Air Outlet: Adjustable pattern diffuser on projection models and two-way louvers on horizontal throw models.

G. Motor: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models. Refer to Section 23 05 13.

H. Capacity: Refer to Drawings, based on 65 degrees F entering air temperature, 145 degrees F average water temperature.

I. Electrical Characteristics:
   1. As per Drawings. Refer to Section 26 05 03.

2.4 CABINET UNIT HEATERS

A. Manufacturers:
   1. Modine Manufacturing Company.
   2. Reznor (Nortek, Inc.).
   3. Rittling (Zehnder Group).
   4. SIGMA Corporation.
   5. Sterling Hydronics (Mestec, Inc.).
   6. Trane, Inc. (Ingersoll-Rand, Inc.).
   7. Vulcan Radiator (Mestec, Inc.).

B. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 100 psi and 220 degrees F.

C. Cabinet: 0.0598 inch thick steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet and inlet grilles.

D. Finish: Factory applied baked enamel.

E. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

F. Motor: Tap wound multiple speed, with sleeve bearings, resiliently mounted. Refer to Section 23 05 13.
   1. electrically commutated-type where available, otherwise permanent split capacitor-type.

G. Control: Multiple speed switch, factory wired, located in cabinet.

H. Filter: Easily removed 1 inch thick glass fiber throw-away or permanent washable type, located to filter air before coil.

I. Capacity: Refer to Drawings..

J. Electrical Characteristics:
   1. Refer to Drawings and Section 26 05 03.
   2. Disconnect switch: Refer to Drawings.

2.5 FAN COIL UNITS

A. Manufacturers:
   1. Basis of Design: Jaga – Type BABW/FF cabinet-style fan coil units.
   2. Subject to compliance with requirements, comparable products by one of the following equals:
   3. Carrier Corporation
   4. Johnson Controls (ENVIRO-TEC)
   5. First Company Products
   6. Trane

B. Unit Configuration:
   1. Type: Hydronic fan coil unit, model BABW/FF, configured for recessed, trench, or architectural integration applications.
   2. Enclosure: Unit designed for installation with field-fabricated architectural louver or grille by others, forming the visible finished surface.
   3. Airflow: Induced room air through architectural louver, across coil, discharged per configuration indicated on Drawings.

C. Coils:
   1. Type: Chilled water and hot water coil.
   2. Construction: Copper tubes with mechanically bonded aluminum fins, optimized for low water temperature operation and high heat transfer efficiency.
   3. Performance: Rated for minimum 200 psig working pressure and 200°F operating temperature.
   4. Drain Pan:

a. Stainless steel or corrosion-resistant material.
b. Fully removable for cleaning.
c. Provided with drain connection as indicated.

D. Casing / Housing:
1. Galvanized or coated steel casing suitable for concealed installation.
2. Internal insulation: Closed-cell or equivalent antimicrobial, complying with indoor air quality requirements.
3. Access: Removable panels for service of fan, motor, and coil.
4. Designed to integrate with field-fabricated louver system without manufacturer-supplied exposed cabinet.

E. Finish:
1. Internal components factory-coated for corrosion resistance.
2. No exposed factory cabinet finish required where concealed by architectural louver.

F. Fans:
1. Type: Tangential or centrifugal fans (per Jaga BABW/FF design).
2. Construction: Dynamically and statically balanced for low-noise operation.
3. Arrangement: Direct-driven fan assembly.

G. Motor:
1. Type: Electronically Commutated Motor (ECM), variable speed.
2. Features:
a. High-efficiency, low power consumption.
b. Integrated speed control capability.
c. Resilient mounting for vibration isolation.
3. Refer to Section 23 05 13 for motor requirements.

H. Controls:
1. Factory-mounted and wired control package.
2. Capabilities:
a. Variable speed control via 0–10V signal or onboard controller.
b. Integration with Building Management System (BMS).
c. User interface (if required): Wall-mounted thermostat or controller (by Temperature Controls Contractor).

I. Filters:
1. Washable or replaceable filter media.
2. Located upstream of coil.
3. Accessibility coordinated with architectural louver design.

J. Mixing Dampers:
1. Provide where indicated on Drawings.
2. Compatible with unit configuration and architectural integration.

K. Capacity:
1. As scheduled on Drawings.
2. Performance shall be based on Jaga selection data for BABW/FF units, including low-temperature heating performance where applicable.

L. Electrical Characteristics:
1. Refer to Drawings and Division 26.
2. Provide factory wiring to single-point electrical connection.
3. Units with electric resistance heat (if scheduled):
4. Include factory-installed heater section.
5. Provide terminal block for single-point power connection.

2.6 INDUCTION DISPLACEMENT UNITS

A. Manufacturers:
   1. Titus HVAC.
   2. TROX USA, Inc. (TROX Technik).

B. Configuration: Primary air plenum with primary air inlet, air balancing damper, nozzles, secondary air inlet, secondary cooling coil and galvanized drain pan, and secondary heating coil.

C. Cabinet Enclosures:
   1. 16 gauge, G90 galvanized steel.
   2. Fabricate cabinet enclosures complete with mounting channels, end trim pieces, mullion spacers, removable front panels, and removable discharge grills.
   3. Top surface flat.
   4. Furnish enclosures to cover induction units continuously or wall to wall.
      a. Shelving: Refer to Drawings. Shall be same manufacturer, construction, and finish as cabinet enclosure.
      b. Filler Panels: Refer to Drawings. Shall be same manufacturer, construction, and finish as cabinet enclosure.

D. Face Panel: Perforated, pencil proof, with minimum 45 percent free area.

E. Base Unit Casing:
   1. 16 gauge, galvanized steel.
   2. Include acoustically insulated primary air plenum, primary air inlets, internal air damper, induction nozzles, cooling coil, heating coil, and drain pan in base units.
   3. Furnish interchangeable transition pieces or plugs for single or series hook up.
   4. Paint portion of unit visible through discharge opening with flat black enamel.
   5. Furnish internal primary air damper of multiple orifice design manually adjustable from under discharge grill.

F. Nozzles: Heat-resistant material suitable for temperatures from 20 degrees F to 200 degrees F with 3.5 wg nozzle pressure.

G. Cooling Coil: One row, 1/2 inch OD copper tubing with aluminum fins.

H. Heating Coil: One row, 1/2 inch OD copper tubing with aluminum fins.

I. Drainable Drain Pan: 0.0396 minimum galvanized steel.

J. Performance:
   1. Refer to Drawings.
   2. Noise Criteria: NC-27.

2.7 CHILLED BEAM

A. Manufacturers:
   1. Titus HVAC.
   2. TROX USA, Inc. (TROX Technik).
   3. Price Industries.

B. Configuration: Ceiling mounted, 24-inch wide active chilled beam with horizontal coil, two-way throw, lay-in border.

C. Cabinet Enclosures:
   1. 20 gauge, G90 galvanized steel.
   2. Fabricate cabinet enclosures complete with mounting brackets, hinged return face, and discharge grills.
   3. Finish is powder coat.
   4. Internal casing painted black.

D. Return Face Panel: Linear bar grille, pencil proof.

E. Cooling Coil: 1/2” connections with air vent.

F. Performance:
   1. Refer to Drawings.
   2. Noise Criteria: NC-27.

PART 3 EXECUTION

3.1 EXAMINATION

A. For induction units, verify shelving and filler panels are correct size.

B. For recessed units, verify recess dimensions are correct size.

C. Verify wall construction is ready for installation.

D. Verify ductwork is ready for installation.

E. Verify concealed blocking and supports are in place and connections are correctly located.

3.2 INSTALLATION

A. Install air coils in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible. Refer to Section 23 31 00.

B. Support air coil sections independent of piping on steel channel or double angle frames and secure to casings. Install with airtight seal between coil and duct or casing.

C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

D. Install coils level.

E. Make connections to coils with unions and flanges.

F. Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window. Align cabinet joints with window mullions. Install wall angles where units butt against walls.

G. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

H. Cabinet Unit Heaters: Install at locations as indicated on Drawings. Coordinate to assure correct recess size for recessed units.

I. Fan-Coil Units: Install at locations as indicated on Drawings. Coordinate to assure correct recess size for recessed units.

J. Induction Displacement Units: Install at locations as indicated on Drawings. Support base units from continuous wall mounting strip or wall mounting brackets. Support cabinet enclosures from wall mounting strip or attach direct to wall and floor.
   1. Drain pans shall be plugged.

K. Chilled Beams: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount height to be flush with ceiling.

L. Protection: Install finished cabinet units with protective covers during remainder of construction.

M. Units with Cooling Coils: Install drain piping to condensate drain. Refer to Section 23 21 13.

3.3 CARBON MONOXIDE ALARMS

A. Install carbon monoxide (CO) alarms in all new and existing rooms containing a fuel-burning appliance per 2020 Minnesota Mechanical and Fuel Gas Code. CO alarms shall be UL 2034 listed.

3.4 INSTALLATION – HYDRONIC COILS

A. On water coils, refer to Drawing Details for piping connections and accessories. Refer to Section 23 21 13.
   1. Induction Units: For multiple unit configurations, install coil accessories according to Drawings.

B. On water coils, connect water supply piping to leaving airside of coil (counter flow arrangement). Refer to Section 23 21 13.

C. On refrigerant coils, install sight glass in liquid piping within 12 inches of coil. Refer to Section 23 23 00.

D. Insulate headers located outside airflow, insulate as specified for piping. Refer to Section 23 07 00.

E. Hydronic Units: Refer to Drawing Details for piping connections and accessories. Refer to Section 23 21 13.

3.5 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Section Includes, but not limited to:
   1. General Requirements for Electrical
   2. Equipment and Materials
   3. General Workmanship and Installation Requirements for Electrical.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 0 and Division 01 Specification Sections apply to this Section.

B. Division 26: Electrical

C. Division 28: Electronic Safety and Security.

D. When a Specification Section refers to other Sections under the Article on Related Sections, this is for Contractor's convenience. It shall in no way relieve the Contractor of responsibilities stated in other Sections of the Specifications, even though these Sections are not referenced. The Contractor is responsible for all information contained in this Division's Specifications as well as for information contained in all other Divisions.

1.3 REGULATORY REQUIREMENTS

A. Meet or exceed all current applicable codes, ordinances, and regulations for all installations. Promptly notify the Engineer, in writing, if the contract documents appear to conflict with governing codes and regulations. The contractor assumes all responsibility and costs for correcting non-complying work installed without notifying the Engineer.

B. Higher quality of workmanship and materials indicated in the Contract Documents takes precedence over that allowed in referenced codes and standards.

C. Perform all work in compliance with the currently adopted version of the following codes and standards for this project:
   1. Energy Codes and Standards:
      a. International Energy Conservation Code (IECC)
      b. Illuminating Engineering Society of North America (IESNA)
      c. American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE 90.1)
   2. International Code Council:
      a. International Building Code (IBC)
      b. International Fire Code (IFC)
   3. National Fire Protection Association Codes and Standards:
      a. NFPA 70 - National Electrical Code
      b. NFPA 72 - Fire Alarm Code
      c. NFPA 101 - Life Safety Code

4. National Electrical Safety Code (ANSI C2)
5. City, State and Local Building Codes and Ordinances
6. City, State and Local Fire Codes and Regulations
7. Occupational Safety and Health Administration Regulations (OSHA)
8. Americans with Disabilities Act (ADA)
9. Uniform Federal Accessibility Standards
10. State Department of Health Codes and Regulations
11. Testing Agencies:
    a. Underwriters Laboratory
    b. Intertek ETL

1.4 REFERENCES

A. Use the latest edition of the standard or the edition required by governing code were referenced in the specifications by the following abbreviations:
1. ANSI American National Standards Institute:
    a. C2 - National Electrical Safety Code.
    b. C62.41-IEEE - Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
2. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
3. CBM – Certified Ballast Manufacturer
4. EPA-Environmental Protection Agency
5. ETL – Electrical Testing Laboratory
6. ICEA - Insulated Cable Engineers Association:
    a. S-95-658 - Thermoplastic-Insulated Wire and Cable.
    b. S-65-375 - Rubber-Insulated Wire and Cable.
7. IEEE Institute of Electrical and Electronic Engineers:
    a. 112 - Standard Test Procedure for Polyphase Induction Motors and Generators.
    b. 519 - Recommended Practices and Requirements for Harmonic Control in Electric Power Systems.
8. IES - Illuminating Engineering Society
9. NBFU - National Board of Fire Underwriters
10. NECA – National Electrical Contractor's Association:
    a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
11. NEC - National Electrical Code
12. NECA – National Electrical Contractors Association:
    a. NECA 101 – Standard for Installing Steel Conduit
    b. NECA 102 – Standard for Installing Aluminum Rigid Metal Conduit.
    c. NECA 111 – Standard for Installing Nonmetallic Raceways (RNMC).
13. NEMA National Electrical Manufacturers Association:
    a. TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
    b. MG 1 - Motors and Generators.
    c. PB 2 - Deadfront Distribution Switchboards.
    d. ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2,000 Volts AC or 750 Volts DC.

e. 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
f. WC 5 - (See ICEA S-95-658).
g. WC 7 - (See ICEA S-95-658).

14. NESC – National Electric Safety Code
15. NFPA National Fire Protection Association
16. OSHA Occupational Safety and Health Administration:
    a. 29 CFR 1910 - Occupational Safety and Health Standards.
17. UL Underwriters' Laboratories, Inc.:
    a. UL-6 - Rigid Metal Conduit.
    b. UL-83 - Thermoplastic - Insulated Wires and Cables.
    c. UL-360 - Liquid-Tight Flexible Steel Conduit.
    d. UL-467 - Electrical Grounding and Bonding Equipment.
    e. UL 486D - Insulated Wire Connector Systems for Underground Use or In Damp or Wet Locations.
    f. UL-508 - Industrial Control Equipment.
    g. UL-651 - Schedule 40 and 80 Rigid PVC Conduit.
    h. UL-797 - Electrical Metallic Tubing.
    i. UL-891 - Dead-Front Switchboards.
    j. UL-913 - Intrinsically Safe Apparatus and Associated Apparatus for Use In Class I, II, and III, Division 1, Hazardous (Classified) Locations.
    k. UL-1012 - Power Units Other Than Class 2.
    l. UL-1449 - Surge Protection Devices
    m. UL-1479 - Fire Tests of Through-Penetration Firestops.

1.5 DEFINITIONS

A. The terms defined below apply to all work included in Division 26.
1. Work: The term "work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.
2. Furnish: to obtain in new condition ready for installation into the work.
3. Install: to store, set in place, connect, and place into operation into the work.
4. Provide: to furnish and install.
5. Connect: to bring service to the equipment and make final attachments including necessary switches, outlets, boxes, terminations, or other final connections.
6. Conduit: in addition to conduit raceways; includes all fittings, pull boxes, hangers, supports, accessories, and all work related to such conduit.
7. Concealed: hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, in crawl spaces or buried.
8. Exposed: not installed underground nor concealed as defined above.
9. Underground: below finished grade or surface exterior of a building, outside of the building foundation.

10. Under or Below Floor: below the finished floor inside the foundations or footprint of a building.
11. Building structure or building structural members - consists of steel columns, steel beams, steel joists (top chord and at panel points), concrete walls and concrete block walls. Metal decking, joist bridging, and bottom chords of bar joists shall not be construed as building structure nor as a building structural member for the purpose of support.
12. SCADA: supervisory control and data acquisition. Includes all control system programable components, software, visual displays, operator interaction devices, control panels, communications, telemetry and all other associated equipment for data acquisition, transmission, processing, monitoring, control, analysis, display, and alarming for an operating and specified control system.

B. The drawing and specifications constitute the Contract Documents. Any item noted in the specification or shown on the drawings is part of the Contract Documents.

1.6 CONTRACTOR RESPONSBILITIES

A. Regulatory Requirements:
1. Initiate, maintain, and supervise all safety precautions required with this work in accordance with the regulations of the Occupational Safety and Health Administration (OSHA) and other governing agencies.

B. Environmental Requirements:
1. Do not remove or disturb any asbestos containing materials from the project. Immediately stop work and notify the Owner if asbestos containing materials are suspected.
2. Do not dispose of any PCB containing materials. Disposal of all PCB containing materials will be the responsibility of the Owner.

C. Provide new, first quality material for all products specified. Do not reuse materials unless indicated or approved by the Engineer.

D. Provide equipment specified in this section which is listed and labeled by a nationally recognized testing laboratory.

E. Comply with ANSI as applicable to equipment specified in this section.

F. Comply with NEMA as applicable to equipment specified in this section.

G. The contractor shall field-verify all dimensions and notify the Engineer or Owner Representative of any conflicts or discrepancies, in writing, prior to submittals and installation. If prior notification is not provided, Contractor is responsible for resolution of all dimensional conflicts.

H. The contractor is responsible for all revisions and changes required to any work needed for compliance with the national electrical code. This includes work to accommodate equipment which was approved as an equal, equipment or work Contractor provided which was not approved but later accepted, work already completed, or any other proposed adjustments to the Contract. Engineer approval of work, submittals, equipment, equals, work changes, or any other contract modifications does not grant the Contractor approval to exclude other work needed to ensure electrical code is still being met.

I. Equipment provided with SCCR ratings/labels shall be provided with sufficient SCCR values to exceed the available short circuit current at the equipment connection point. Where short

circuit current is not identified in the Contract Documents, the contractor is responsible for providing the necessary calculations for coordination.

J. Include better quality, greater quantity or higher cost for an item or arrangement where a disagreement exists in the drawings and specifications. If multiple different scenarios, situations, or materials are proposed for a single item or design case, include the cost of all work for scenarios and situations included in the Contract Documents, unless noted otherwise.

K. The contractor shall have knowledge of the latest edition of NFPA 70 (NEC) and additional governing codes. In addition to the work shown in the Contract Documents, Contractor shall provide all work to comply with these references. If there is a conflict with the Contract Documents and such governing codes, the Contractor shall alert the Owner Representative during the bidding review period and prior to the final questions date. If the Contractor fails to do so, additional services will not be awarded to the Contractor to perform work to correct issues which are conflicting with governing code requirements nor to satisfy the AHJ inspection comments. All work is to be included in Base Bid or other work proposed to the Contract.

L. Contractor shall notify Engineer or Owner Representative of issues or questions with ample time to allow Owner, Engineer, and designer to review and respond to the request before Contractor purchases and/or installs such equipment. By submitting a bid, the contractor agrees and acknowledges the Owner, Engineer, and Project Representative cannot and will not be held responsible for delays in the project or increases in costs due to Contractor failure to provide ample notice to allow review of and response to the potential issue. The acceptable duration of such ample notice will be determined by the Owner Representative, and duration will be based on the complexity of the request, however duration shall not at any time be expected to be less than 10 business days from the date the electrical Engineer of Record receives the request. In recognition of this, Contractor is to plan, coordinate and schedule construction accordingly. Failure to do so will result in a violation of the Contract.

1.7 PROJECT/SITE CONDITIONS

A. Site Inspections:
   1. Before submitting a proposal on the work contemplated, examine the site of the proposed work, and become thoroughly familiar with existing conditions and limitations. No extra compensation will be allowed because of misunderstanding as to the amount of work involved nor the bidders' lack of knowledge of existing conditions which could have been discovered or reasonably anticipated prior to bidding.
   2. Raceways, pipes, ducts, lights, devices, speakers, etc., shown on the drawings as existing have been based on existing plans and casual site observations, and may not be installed as originally shown. It is the Contractor's responsibility to visit the site and make an exact determination of the existence, location, and condition of such facilities prior to submitting a bid.

B. Correlation of Work:
   1. Consult the drawings and specifications of all other Divisions to correlate information and layout work so that it will coordinate with other trades. Verify dimensions and conditions (i.e., finished ceiling heights, footing and foundation elevations, beam depths, etc.) with all drawings. Notify the Engineer of any conflicts that cannot be resolved in the field by

affected trades. Replacement of work due to lack of coordination and failure to verify existing conditions will be completed at no cost to the Owner.

2. Install all conduits, cable tray, busduct, equipment, etc. allowing proper code and maintenance clearances to avoid blocking passageways and access panels.
3. Where work must be replaced due to the failure of the Contractor to verify the conditions existing on the job, such replacement must be accomplished at no cost to the Owner. This applies to shop fabricated work as well as to work fabricated in place.
4. Throughout the course of the work, minor changes and adjustments to the installation may be requested by the Engineer. The Contractor shall perform adjustments without additional cost to the Owner, where such adjustments are necessary to the proper installation and operation within the intent of the Contract Documents. This does not include work already completed.
5. Obtain the exact location of connection to equipment, furnished by others, from the entity furnishing the equipment.

C. The Contract Documents shall govern in the instances where requirements indicated are greater than those stated in the governing codes and standards.

1.8 FIRESTOPPING

A. Provide firestopping around all new penetrations, sleeves and openings through all partitions, walls, and floors.

B. Provide UL listed components installed by certified and factory trained personnel.

1.9 SEQUENCING AND SCHEDULING

A. Refer to General Conditions and Requirements.

1.10 EQUIPMENT INSTRUCTIONS AND PARTS LITERATURE

A. Instruction and parts literature are generally packed with electrical equipment and devices. Contractors shall remove this literature from the packing container or equipment enclosure, identify the literature with the equipment to which it applies, and file the literature in loose-leaf binders with index tabs. Each binder shall have an index which lists each piece of equipment and the literature which applies to it. An index tab shall be provided for each piece of equipment.

B. Contractors shall establish a procedure with the other trades for receiving, identifying, and filing literature for devices which are removed from their packaging and installed by other trades.

1.11 SUBMITTALS

A. Submit the following items consistent with Division 0 and Division 1. Refer to each Section under Division 26 for additional submittal requirements particular to that Section.

B. Prior Approvals:
1. Submit approval form for each request for prior approval.
2. Submittals shall be formally presented to the Bradbury Stamm. Submittals presented to the Engineer prior to approval of the Bradbury Stamm will not be reviewed or accepted.
3. Submit electronic, written requests to use unspecified items, to the Engineer, no later than ten (10) business days prior to the bid opening. Submit detailed information for proposed

material or equipment specific to the project, clearly indicating all options included in the submittal.

4. Accepted substitutions will be incorporated in an Addendum to the Contract Documents.
5. The contractor is responsible for dimensional differences, electrical requirements, and any other resulting changes, when using accepted substitutions. The contractor is responsible for any additional costs incurred because of substitutions, including other contractors and Engineer fees.
6. Material and equipment not specified or accepted in an Addendum will be removed and replaced at no cost or inconvenience to the Owner.

C. Work Scope Change:
   1. If a work scope change is requested and the Contractor would like to be awarded additional compensation or a deduct from original contract is requested, Contractor shall provide a schedule of values for all associated proposed work.
      a. Pricing shall be grouped to represent each itemized work scope change.
      b. Each piece of equipment shall be itemized, along with the cost of item. Labor to install said item shall be presented on a separate line item.
      c. Provide a final lump sum number for all work associated with the change and individual pricing for each item on the schedule of values.
      d. Engineer may request additional breakdown for improved clarity and Contractor must comply prior approval for the additional compensation or credit.
      e. Comply with the requirements set forth in Division 0 and Division 1.
   2. The contractor shall provide actual manufacturer and distributor invoices or quotations showing the costs of material and work affected by the scope change upon request of the Engineer or Owner representative.
   3. Contractor is solely responsible for delays in schedule where Contractor is required to resubmit documentation, revise requested documentation or provide additional information associated to gaining approval for the work scope change.

D. Shop Drawings and Manufacturer's Information:
   1. Submit in accordance with Division 0 and Division 1. Unless noted otherwise, submit drawings to the Engineer for review within 30 calendar days after the award of Contract.
   2. Provide digital copy in a PDF format:
      a. Files shall be accessible and neatly organized.
      b. Provide a table of contents which utilizes bookmarks and links. The links shall take the reader to a specific page when the reader clicks on the desired title in the table of contents. A link shall be provided for materials associated with each piece of equipment included in the O&M manual.
      c. Product literature which demonstrates compliance with the specifications shall be highlighted or otherwise identified to be easily found.
   3. Provide separate files for each submittal for each section. Combination submittals will be returned to the Contractor without review and count as 1 submittal. Do not combine submittals from multiple sections.
   4. Include project name, name of Engineer, contractor, sub-contractor, manufacturer, supplier, and sales representative, include name, address, and phone number for the sales

representative. Clearly identify section number and description of equipment submitted. Shop drawings not including all this information will be returned without review, and count as 1 submittal.

5. Examine all shop drawings noting capacity, arrangement, and physical dimensions. Clearly mark all relevant items on catalog data and cross-out unrelated information.
6. Submittals for equipment provided by the Electrical Contractor shall bear a stamp or specific written certification from the Electrical Contractor, certifying the submittals have been reviewed and approved by the submitting Electrical Contractor.
7. Provide the following manufacturer documentation:
    a. Product Data Sheets:
        1) Product and component documentation that describe all equipment and devices proposed to be provided.
        2) Include all features specified.
        3) Provide dimensioned prints with weights.
        4) Highlight or otherwise accentuate on each document product numbers and description of product features which demonstrate compliance with the Contract Documents.
        5) Features or part numbers which do not apply shall be struck through, crossed out, blacked out, or otherwise identified as not applicable.
        6) Documentation which does not have such marking, and edits may be rejected and counted as one instance of Contract failure to meet submittal requirements and resubmit.
    b. Composite Drawing:
        1) Power and control wiring diagrams for all systems and equipment. Control equipment to be provided with ladder type schematic diagrams.
        2) Show basic systems on composite drawing.
        3) Use terminal numbers on drawings and schematics.
        4) Use separate drawings to show details of sub-systems.
        5) Identify sub-system drawing interface points on composite drawing and sub-system drawings; terminal numbers of interface points shall be the same on both drawings.
        6) Revise or redraw manufacturer’s standard drawings to meet the above requirements.
        7) Documentation which does not have such marking, and edits may be rejected and counted as one instance of Contract failure to meet submittal requirements and resubmit.
    c. Record all Changes to Existing Systems:
        1) Revise all wiring diagrams and schematic diagrams to show final installation:
            a) Includes all new and existing equipment diagrams.
    d. Programmable Systems:
        1) Description of programmable system operation, including but not limited to input/output functions, control capabilities, configuration procedures, starting setpoints, etc.

2) Preliminary graphic screens and reports.
a) This submittal shall occur prior to shipment of the system.

e. Manufacturers Installation Instructions:
1) Include with shipment.

E. Operating and Maintenance Manuals:
1. Include all the information provided with the approved shop drawings and manufacturer's information.
a. Update and complete control system drawings and descriptions for all equipment.
b. All documentation shall include modifications made which reflect the final installation.
c. Provide complete testing reports.
2. Date the manuals with the day, month, and year they are provided to the Owner/Engineer.
3. Provide manufacturers' user manuals and installation instructions.
4. Provide 2 digital copies in a PDF format saved to a USB drive. The saved files shall be clearly identified and organized in a similar manner to the hard copies.
a. Digital files to be accessible and neatly organized.
b. Provide a table of contents which utilizes bookmarks and links. The links shall take the reader to a specific page when the reader clicks on the desired title in the table of contents. A link shall be provided for materials associated with each piece of equipment included in the O&M manual.
5. Record all Changes to Existing Systems
6. Insert revised documents into the Owner's existing operation and maintenance manuals in place of original documents, if such O&Ms exist.

F. Record Documents:
1. Provide two digital pdf copies.
2. To be provided with the O&M's.
3. Record drawings shall include all work scope changes, including addenda.
4. Record drawings shall show locations of all above ceiling control devices, such as relays, contacts, control modules, monitor modules, power packs, fire/smoke detection equipment, etc.
5. Refer to Contract Documents for additional Record Drawing requirements.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All electrical and control equipment and materials shall be provided as specified in the Contract Documents.

B. Where applicable, equipment and materials shall conform to ANSI, ICEA, IEEE, and NEMA Standards.

C. All equipment and materials shall be new and shall bear the Underwriters Laboratories (UL) label if UL labels such product types. If UL does not label the product type, UL listed will be then required and documentation of such listing shall be provided. If UL does not label or list the product the type, other third-party testing agency certification which is recognized and

accepted by the most recent published version of the national electrical code (NFPA 70) will be allowed.

2.2 TAMPERPROOF HARDWARE

A. Where tamperproof hardware is called out, provide torx head with center pin reject hardware for the following electrical work:
   1. Light fixture housings
   2. Covers to electrical enclosures, pull boxes, cabinets, junction boxes, wireways.
   3. Cover plates (both maximum security and stainless-steel cover plates)

2.3 HAZARDOUS LOCATIONS

A. An area identified where fire or explosion hazards may exist due to flammable gases, flammable liquid-produced vapors, combustible liquid-produced vapors, combustible dusts or ignitable fibers/flyings.

B. Installations in areas identified as hazardous locations, at a minimum, meet the requirements of the latest edition of the National Electrical Code (NFPA 70). Where specifications are more conservative than the National Electrical Code requirements, the specification shall be followed.

C. Refer to drawings for hazardous location identifications.

D. All installations in Class 1, Division 1 and 2 hazardous locations shall meet the NEC requirements for a Class 1, Division 1 hazardous location. Unless noted otherwise.

2.4 CORROSIVE ENVIRONMENTS

A. A corrosive environment is an area or space which there are gases, vapors, liquids, or other material cause a caustic effect on materials, more so than standard air.

B. All products supplied in corrosive environments shall be suitable for installation and resist corrosion which may be caused by the potentially present caustic agent.

C. The following areas shall be considered as a corrosive environment.
   1. Chemical rooms.
   2. Pool Storage.

PART 3 EXECUTION

3.1 CONSTRUCTION LIGHTING & POWER SYSTEM - REMODELING

A. Provide construction power and lighting that adheres to the NEC Article 590 – “Temporary Installations.”

B. Refer to Division 1 for temporary electrical services.

C. For remodeling work in the existing building, use existing building distribution systems for construction power.

D. Replace all receptacles, switched, cover plates, etc., damaged by any Contractor during construction.

E. Materials furnished for the temporary light and power system remain Contractor’s property. Remove when there is no longer any need for temporary light and power or when directed by the Project Representative.

F. The Owner shall pay electrical energy costs.

3.2 CONSTRUCTION LIGHTING & POWER SYSTEM – NEW CONSTRUCTION

A. Provide construction power and lighting that adheres to the NEC Article 590 – "Temporary Installations."

B. Furnish, install, and maintain a construction lighting and power system, as directed herein for the use of all trades. As soon as a directive to proceed is issued, arrange with the power company suitable temporary power:
   1. Provide not less than ½ watt per square foot for temporary lighting with a minimum of one light per room or space. Provide 200 watt, inside frosted, incandescent lamps for each outlet.
   2. Provide 20-amp, 120-volt, single phase duplex, grounding type, receptacles, and 50-amp, 240-volt, single phase receptacles. Locate receptacles so no location in the building is more than 75 feet from either type of receptacle. Provide ground fault protection as required by the NEC.

C. Materials furnished for the temporary light and power system remain Contractor's property. Remove when there is no longer any need for temporary light and power or when directed by the Owner Representative.

D. Electrical energy costs for the temporary separate system paid by the Owner.

E. Power company connect-and-disconnect charges for Contractor trailers and equipment shall be paid by the Contractor.

3.3 PREPARATION

A. Continuity of Service:
   1. No Division 26 systems are to remain inactive at the end of the workday. Assure that the systems are all operational at the end of each workday. Coordinate temporary outages with the Owner.
   2. Coordinate/schedule all work with the Owner to minimize any disruptions. Confine all interruptions to the smallest possible area. Provide temporary connections if required to provide continuity of service.
   3. Inspect all areas affected by the interruptions and return all automatically controlled equipment, electrically operated equipment to the same operating condition prior to the interruption.

B. Use of Facility:
   1. Do not disturb normal use of the facility, except within the immediate construction area. Keep walks, driveways, entrances, etc. free and clear of equipment, material, and debris.
   2. Store all equipment and material in a place and manner that minimizes congestion and is approved by the Owner.

3.4 INSTALLATION

A. Material and Workmanship
   1. Provide new material and equipment, unless noted otherwise. Protect equipment and material from damage, dirt, and the weather.

2. Provide the highest quality workmanship and perform all work only by skilled mechanics. Install material and equipment in accordance with manufacturers' recommendations, instructions and current NECA standards.
3. The Engineer reserves the right to reject material or workmanship not in accordance with the specifications, before or after installation.
4. Engineer and Owner have the right to determine if equipment, boxes and covers are not accessible. Where electrical work is determined to be not accessible, Contractor shall modify the work as directed at no additional cost to the Owner.

B. Excavation and Backfilling:
1. Provide all excavation and backfilling required to complete the installation of the electrical system. Conform with the provisions of Division 31 Earthwork of these specifications for all work.
2. Bed all conduit and structures on a 6" thick compacted layer of granular material. Should unsatisfactorily soil conditions be discovered, the Owner Representative will inspect the excavation and determine the necessary additional support required.
3. Backfill around raceways and structures by hand using coarse sand, pit run gravel or the native material if it is like the above. Remove all large stones, frozen lumps, perishable rubbish, and excessive amounts of clay. Carefully compact this material in 6" layers to a depth of 8" above the conduit, cable, or duct. Compact to not less than 90% outside the building and 95% within the building limits of maximum density given by ASTM D698-70T (Standard Proctor Density). Owner Representative reserves the right to require soil compaction tests in any areas which do not appear to be compacted properly with the cost of the test paid by the Contractor.
4. Replace all existing surface improvements (i.e., street pavement, curbs, sidewalks, finish sodding, etc.) removed or damaged in the course of the work unless such improvements are to be reconstructed under the general contract. Make all necessary arrangements to perform such repairs, pay all costs in connection therewith and include them in the bid.

C. Cutting and Patching:
1. Perform all cutting and patching necessary to work, unless specifically delegated to be performed under a different Division.
2. Obtain special permission from the Engineer before cutting structural members or finished material.
3. Perform all patching in a manner as to leave no visible trace and return the affected area back to the condition undisturbed before work began. All patch work to be performed by workers experienced, skilled, and licensed for the work involved. Work deemed unacceptable by the project Bradbury Stamm will not be accepted.
4. Patch all holes left because of demolition of electrical equipment and devices.
5. Drill all holes in masonry with rotary drill. Impact tools are not allowed. Core drill all holes in masonry and concrete for electrical raceway. Provide and dispose of all water required for core drilling. Coordinate with other trades to prevent damage from water.
6. Prevent the spread of dust, debris, and other material into adjacent areas.
7. Replace all ceiling tiles damaged during installation work with new tile.

D. Painting:
   1. Refinish all electrical equipment damaged during shipping and/or installation to its original condition. Remove all rust; prime, and paint per manufacturer's recommendations for finish equal to original.
   2. Paint all new raceway systems in exposed finished areas to match existing finish.

E. Coordination:
   1. Coordinate the location of all outlets and the associated equipment with all facility systems before installation.
   2. Coordinate all door swings in the field before locating devices.
   3. The contractor shall be responsible for obtaining the exact dimensions, locations, electrical ratings, and termination requirements of equipment furnished by others, from the entity furnishing or supplying the equipment.
   4. If the conduit, wiring, or other equipment cannot be installed per the contract documents, including but not limited to installing concealed or in a designed space, Contractor shall notify the project Engineer or Owner Representative prior to submitting on proposed equipment and prior to starting installation of such equipment.
   5. Coordinate all equipment dimensions before submitting equipment. This includes all shop fabricated work as well as work fabricated in place. It shall be assumed that equipment submitted have been coordinated by the Contractor and the act of submitting the documents indicates Contractor and all trades have verified equipment will fit in allocated location space.
   6. If the Contractor believes there is, or finds a workspace issue, Contractor shall notify project Engineer or Owner Representative prior to submitting on such equipment. Replacement or modification of equipment and/or modifications in the surrounding space it is to be installed, shall be completed by the Contractor at no additional cost to the Owner due to lack of the contractor coordination and the contractor failure to spend the energy and resources to verify the existing conditions.

3.5 FIRESTOPPING

A. Provide firestopping around all new penetrations, sleeves and openings through all partitions, walls, and floors.

B. Install firestopping on both sides of each partition, completely filling the void around the opening.

C. The firestopping of interior of conduits and sleeves is by the contractor providing the cabling inside the conduit or sleeve.

3.6 ELECTRIC FIRE AND SMOKE DAMPERS

A. Division 26 Contractor shall provide power to all smoke, fire, smoke/fire dampers which are rated 120V AC or greater.

B. Wiring for fire alarm and other life safety monitoring and alarm shall be provided under Division 28.

C. The contractor is responsible for coordinating the locations and requirements of the electric damper actuators with the equipment supplier and the Mechanical Contract Documents. Not

all damper actuators may be indicated in the Electrical Contract Documents, refer to Division 22 and 23 and the HVAC Drawings for additional information.

3.7 RECEIVING AND STORING EQUIPMENT

A. All equipment shall be handled and stored in accordance with the manufacturer's instructions.

B. In general, equipment packaging is not designed to protect the contents for outdoor storage. As a minimum, Contractor shall store the equipment prior to installation in a clean, dry location free from excessive temperatures, humidity, or foreign materials normally encountered at a Site. If the storage facility is unheated, Contractor shall provide heating to protect equipment from condensation, which could cause components to corrode or to be otherwise damaged.

3.8 EQUIPMENT MOUNTING

A. Unless noted otherwise, equipment which is not free-standing shall not be mounted on wood panels, but shall be attached to concrete or masonry walls, support channels, or building structural steel.

3.9 FIELD QUALITY CONTROL

A. Refer to Contract Documents for additional requirements.

B. Final Observation:
   1. A final inspection of the electrical systems will be required before the Contract can be closed out. Request a final inspection by the Engineer after all systems are fully completed and operational. The Engineer will schedule an observation and generate a list of items to be corrected or completed before Contract Closeout. If the Contractor notifies the Engineer the work is ready for final observation, final evaluation of control systems, or commissioning exercise by the Contractor, and the Engineer finds the work is not complete enough to perform that observation, the Contractor will compensate the Engineer time used. The Contractor will then perform the necessary work to complete the project and again request a Final Observation.

3.10 CLEAN UP

A. Keep the premises free from accumulation of waste material or rubbish, caused by his employees or work, always. Remove rubbish, tools, scaffolding, and surplus materials from and about the building, and leave work areas "broom clean" or its equivalent upon completion of the work. Clean electrical equipment and remove temporary identification. In case of dispute the Owner will remove the rubbish and charge the cost to the Contractor.

B. After tests have been made and are accepted, the Contractor shall clean light fixtures, panels and other equipment installed by the Contractor, leaving the entire work area in a clean and complete working order.

3.11 PROTECTION

A. Cover openings and equipment, where set, to prevent obstruction to raceways and boxes, breakage, misuse, or disfigurement of equipment. Cover openings in equipment immediately upon uncrating or receipt at the job site and keep covered until permanent connection is made.

B. The contractor is responsible for any damage to electrical equipment or materials until final acceptance of the entire project by the Owner. Keep all equipment clean materials until final acceptance of the entire project by the Owner.

C. If a portion of the project is to be occupied by the Owner prior to Substantial Completion of the entire project, Owner Representative will schedule with the contractor and have final decision when to transfer responsibilities for protection and housekeeping.

END OF SECTION

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SECTION 26 05 10

SELECTIVE ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all labor, material, equipment, and services necessary and incidental to complete all the selective and or complete demolition and removal of electrical systems in the areas of remodeling or affected by remodeling, and the rework and extension of electrical systems indirectly affected by electrical system served “downstream” from the demolished electrical systems.

1.2 REFERENCES

A. Sections 26 05 00 and all references contained therein form a part of this Section of the Specifications.

1.3 ASBESTOS

A. Coordinate demolition with the Owner’s asbestos abatement contractor to ensure that all required demolition is included in the project. Any demolition work not included in the asbestos abatement contractor’s work, but required for the electrical work under this project shall be included under this section by the Division 26 contractor. Coordinate work with the asbestos abatement contractor closely, especially where equipment or devices are noted on the plans to be reused or protected.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Demolition Drawings are diagrammatic and based on casual field observation and existing record documents. Report discrepancies to Owner Representative before disturbing existing installation.

B. Examine the building to determine the actual conditions and extent of work prior to bidding on the project. Refer any unclear details or conflicts to the Owner Representative for clarification prior to bidding the drawings.

C. Refer to all documents for additional demolition requirements which may be required to include in the bid.

D. Verify that field measurements and circuiting arrangements are as shown on Drawings.

E. Verify that abandoned wiring and equipment serve only abandoned facilities.

F. Beginning of demolition means contractor accepts existing conditions.

3.2 PREPARATION

A. Coordinate phasing of the demolition work with the construction sequence schedule.

B. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

C. Coordinate utility service outages with Utility Company.

D. Identify and provide new supporting means for existing electrical equipment such as low voltage cabling, conduits, boxes, pull boxes, conduit bodies, and conduit racks that will need additional support due to the demolition of the existing supports. This includes existing systems which are identified to require support and become exposed when ceilings are removed.

E. Contractor shall provide new supports for all existing electrical conduit, cabling, fixtures, and devices which is not supported per the requirements of the NEC and becomes uncovered due to removal of ceilings or walls.

F. Erect, and maintain temporary safeguards, including warning signs and lights and barricades for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

G. Provide temporary emergency lighting and illuminated exit signage as required by the Building Official or AHJ.

H. Electrical Service:
   1. Maintain existing system throughout construction in service until new system is complete and ready for service.
   2. Disable system only to make switchovers and connections. Notify and obtain permission from Owner Representative at least 24 hours before partially or disabling system. Minimize outage duration.
   3. Make temporary connections to maintain service in areas adjacent to work area.

I. Contractor to coordinate and sequence demolition to avoid shutdown of operation of surrounding areas.

J. Conduct demolition to minimize interference with adjacent and occupied building areas.

K. Perform noisy work before or after the Owner's working hours to minimum disruption.

L. Contractor assumes responsibility if damage occurs to all devices to be reinstalled. If Contractor finds a damaged piece of equipment prior to demolition, Contractor shall note the equipment and notify the Owner's Representative and Engineer prior to removing the items. If Contractor does not provide the proper notification, Contractor will be held responsible for repairing or replacing the damaged equipment.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Owner reserves the right of first refusal to obtain material shown to be removed under this contract. Items not retained by the Owner become the property of the Contractor and must be removed from the premises and disposed at no additional costs to the Owner.

B. Demolish electrical systems in walls, floors, and ceilings identified to be demolished.

C. Demolish and extend existing electrical work under and this Section or as indicated on the Drawings. Remove devices, conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

D. Demolish and remove all electrical systems indicated for demolition. No portion of these systems may be abandoned in place.

E. Remove, relocate, and extend existing installations to accommodate new construction or to maintain systems downstream from demolished area.

F. Provide support for all existing electrical equipment that was supported previously by demolished walls, floors, ceiling, or other structures. Provide new supports from structural members not slated for demolition, prior to any demolition.

G. Remove abandoned wiring to source of supply.

H. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit in walls, floors, or columns back to a point where patching can be adequately performed and patch surfaces.

I. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if raceway serving them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

J. Disconnect and remove abandoned panelboards and distribution equipment.

K. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

L. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.

M. Repair adjacent construction and finishes damaged during demolition and extension work.

N. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

O. Relocate and reroute conduit and wiring to remain which is concealed in walls or structure being altered as part of the part. Maintain continuity to all devices in and downstream of project area. Existing installations to be extended using materials and methods compatible with existing electrical installations, or as specified.

P. Reroute existing raceway and wiring which. is exposed due to removal of existing construction. Conceal new raceway and wiring and maintain operation.

Q. If conductors are required to be removed from existing raceways, install with new conductors.

R. Provide new device cover plates throughout the remodeled areas.

S. Dispose of fluorescent lamps, ballasts, and other hazardous materials in accordance with State and Federal regulations.

T. Seal all holes and openings left in smoke, sound or fire rated walls, ceilings, or floors. Completely fill with intumescent type fire rated barrier.

U. When ceilings are to be removed and ceiling devices such as luminaires, receptacles, WAP’s, fire alarm equipment, security equipment, and others is indicated to be removed and reinstalled, Contractor shall remove and store the equipment offsite until the project has advanced enough and the equipment can be reinstalled. The Contractor may elect to temporarily support the devices in place; however, Contractor must coordinate this with all disciplines and Contractor is responsible for removing and/or relocating the equipment as needed during the project.

3.4 EXISTING PANELBOARDS

A. Identify circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits which are available for reuse. Reuse breakers if possible. Provide new breakers for new equipment unless breakers are specifically noted on the plans to be reused.

B. Tag unused circuits as spare and turn breakers and/or switches off.

C. When existing circuits are indicated to be reused use verify these circuits are not already in use by other circuits.

D. Remove existing wire no longer in use from panel to equipment.

E. Where existing panelboards are indicated to be demolished, extend any remaining live circuits to the nearest suitable panelboard.

F. Clean out debris, dust and dirt from existing panelboards which are modified under this project.

G. Provide updated panelboard schedules at the end of every work shift. Temporary panel schedules may be handwritten and posted on or near the panelboard.

H. Provide new updated machine typed directories for every panelboard modified under this project prior to substantial completion. Directories to be provided in a clear protective sleeve attached to inner side of panel door.

3.5 CLEANING AND REPAIR

A. Prior to reinstallation of used equipment, thoroughly inspect each item and report any defects to the Owner Representative in writing. Instructions for corrective measures will be given at the time and the Contract amount adjusted accordingly. If no defects are reported, the material will be included under the project warranty.

B. Equipment: Clean exposed surfaces and interior. Check tightness of electrical connections.

C. Luminaries:
   1. Where existing luminaries are indicated to be re-used, remove existing luminaries for cleaning. Use mild detergent to clean all exterior and interior surfaces, rinse with clean water and wipe dry.
   2. Replace ballasts, lamp holders or other parts which become damaged due to work during the construction period.
   3. Provide new lamps.

D. Repair adjacent construction and finishes damaged during demolition and extension work.

3.6 INSTALLATION

A. Install relocated materials and equipment as indicated on the drawings.

END OF SECTION

SECTION 26 05 19

CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes, but not limited to:
   1. Wire
   2. Metal Clad (MC) Cable
   3. Retractile (Coiling) Cords
   4. Retractable Corded Reels
   5. Terminals and connectors.
   6. Installation.
   7. Splices, Taps, and Terminations.
   8. Identification.

1.2 REFERENCES

A. Section 26 05 00: Common Work Results for Electrical

B. Section 26 08 00: Testing and Adjustments to Electrical Systems

1.3 SUBMITTALS

A. Submit shop drawings and descriptive data in accordance with Section 26 05 00.

PART 2 PRODUCTS

2.1 WIRE

A. All wire and cable shall be:
   1. New and coiled or on reels.
   2. Each coil and/or reel shall have a label with the manufacturer's name, trade name of wire, size of wire, and UL label.

B. Provide conductors with a 90ºC insulation system, 600-volt rating, U.L. approved and listed for specific application.

C. Feeder and Branch Circuit Wire:
   1. Stranded conductor, unless noted otherwise.
      a. Solid copper conductors are to be used for lighting and convenience receptacle circuits.
   2. THWN insulated for conductor sizes #4 AWG and smaller.
   3. XHHW or THWN insulation for conductor sizes #3 AWG and larger.

D. Provide minimum No. 12 AWG conductor size, unless noted otherwise.
   1. Where noted conductors used for control to/from field devices may be less than 12AWG in size providing the following requirements are met:
      a. Unless otherwise specified elsewhere in these specifications, control wiring shall be not less than No. 14 AWG.

b. Control wiring shall be sized such that the voltage drop under in-rush and continuous operation conditions does not adversely affect operation of the controls.

E. Conductors may be copper or aluminum, within the constraints of the specifications.

2.2 METAL CLAD (MC) CABLE

A. Provide MC cable only where specifically allowed.

B. Provide UL Listed cable, rated for 600 volts and 90ºC.

C. Provide factory assembly of one or more conductors enclosed in a metallic sheath that consists of a continuous flexible corrugated aluminum interlocked armor.

D. Separate equipment grounding conductor.

E. Each conductor shall be separately insulated in the cable, including ground wire(s).

2.3 RETRACTILE (COILING) CORDS

A. Cord to extend up to 5x its retracted length. Provide extended length as required per the application.

B. Minimum #18 AWG size stranded copper with color-coded rubber insulation.

C. Type SJO overall jacket, black neoprene.

D. Approved Manufacturer:
   1. Alpha 660/2
   2. Belden 9476
   3. Or equal.

2.4 RETRACTABLE CORDED REELS

A. 20-foot retracting utility cord reel.

B. 12 AWG, 3-conductor cable.

C. Rigid ceiling mount.

D. Provide a 20-amp receptacle at end of cord.

E. 11-amp rating at 125 volts.

F. UL recognized.

G. Painted black housing with a white cord finish.

H. Automatic spring retraction.

I. Ratchet lock that can be disengaged for a constant tension.

J. External spring tension adjustment.

K. Adjustable ball stop on the cord. Verify with Owner ball stop location.

L. 18-inch primary cord length minimum with receptacle included.

M. Manufacturer: Woodhead, or equal.

2.5 WIRE COLOR CODING

A. Contractor may use color coding at his discretion, except for the following colors, which shall be used only as designated below for both power and control circuits.

1. Control Circuits
    a. Dark Blue - Direct current circuits.
    b. Light Blue - Intrinsically safe conductors.
    c. Green - Grounding conductor.
    d. White - Neutral conductor.
2. Power Circuits

	120/240V	208Y/120V	480Y/277V
Phase A	Black	Black	Brown
Phase B	Red	Red	Orange
Phase C		Blue	Yellow
Neutral	White	White	Gray
Ground	Green	Green	Green

3. Use solid colors through Size No. 8 AWG.
4. Use black conductors with tape color identification No. 6 AWG and larger.

2.6 TERMINALS AND CONNECTORS

A. Tool compressed terminals and connectors shall be made of 1 piece seamless highly conductive copper with a uniform tin-plate coating to minimize corrosion.

B. Step-down adapters shall be copper compression type.

C. Electrical spring connectors:
    1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for application used.
    2. The integral insulator shall have a skirt to completely cover the stripped conductors.

D. Electrical push-in connectors:
    1. Nylon/PC housing material.
    2. Copper contacts with tin plating.
    3. Rated for 221-degree F.
    4. 2,3 or 4 port as needed per circuit. Do not provide unused ports.
    5. Sized per wire gauge.
    6. To be used with wire gauge 12 and smaller.
    7. UL Listed.
    8. Manufacturer:
        a. Ideal
        b. Or pre-approved equal.

E. Fork Terminals:
    1. Vinyl or nylon self-insulated locking type.
    2. Terminal insulation that supports wire insulation.
    3. Manufacturer:
        a. Thomas & Betts Type FL

b. Burndy Type TP-LF
c. Panduit Type PNF
d. 3M Type MNG.

F. Electrical Tape:
1. UL Listed.
2. Weather resistant.
3. Moisture resistant vinyl.
4. Rated for the voltage system which it is applied.
5. Temperature rating suitable for the application where it is applied.

G. Motor Connection Kit:
1. UL Listed.
2. Qualified to ANSI standards.
3. Rated to withstand 1000V.
4. For use on in-line or stub motor lead splices.
5. Resistant to abrasion.
6. Installed per manufacturer's recommendations.

H. Underground Splices for No. 10 AWG and Smaller:
1. Solderless, screw-on, reusable pressure cable type, with integral insulation. Listed for wet locations and approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

I. Underground Splices for No. 8 AWG and Larger:
1. Mechanical type, of high conductivity and corrosion-resistant material. Listed for wet locations and approved for copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. The insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be products of the same manufacturer.

2.7 CONDUCTOR PULLING COMPOUND

A. Rated for use with conductor insulation and conduit material.

B. Non-conductive.

C. Non-cementing.

D. Dry to a fine lubricating powder or a thin film which does not harden in conduit.

E. UL Listed.

F. Rated for repeated exposure to high heat or freezing temperatures.

2.8 CONDUCTOR IDENTIFICATION

A. Imprinted labels
1. UL Listed.
2. Machine typed in blank ink.

B. Label Sleeves
   1. Non-burning.
   2. Heat-shrinkable.
   3. Clear.
   4. UL Listed.

C. Self-Laminating
   1. Vinyl.
   2. Wrap around.
   3. Acrylic adhesive.
   4. Water and Oil Resistant.
   5. UL Listed
   6. Machine typed in blank ink.

D. Manufacturers:
   1. Brady
   2. 3M
   3. Raychem TMS
   4. Thomas & Betts E-Z Code

PART 3 EXECUTION

3.1 WIRE INSTALLATION

A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.

B. Install all conductors in a continuous raceway system.

C. Splice conductors only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.

D. Pulling compound shall be approved by the cable manufacturer.

E. Conductors of different voltage systems shall not be installed in the same raceway.

F. Examine all wires before installation. Do not use any wire with insulation that is damaged in any way.

G. Do not pull wire into the conduit until the conduit system is complete. Pull all conductors into the raceway at the same time.

H. Adequate measures are to be employed to determine that the raceways are free of foreign material and moisture before pulling wire or cable.

I. Test all cable and wire for continuity and for shorts prior to energizing any circuits.

J. Conductors shall extend at least 4” past the point of the cover on any junction or pull box installed.

K. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.

L. Conductors shall be without splice from termination to termination, unless indicated otherwise on the Drawings.

M. Provide an equipment grounding conductor with each circuit.

N. The use of a shared neutral on multiwire branch circuits will not be allowed. Each circuit shall be provided with its own neutral conductor(s), unless noted otherwise in the Contract Documents.

O. The contractor shall provide conductors with the appropriate rating and quantity for each circuit.
   1. Voltage Drop Calculations:
      a. Wire shall be sized for a voltage drop no greater than 2% measured for circuits used to feed panelboard, distribution panels, switchboards, and service equipment.
      b. Wire shall be sized for a voltage drop no greater than 3% measured from the feeder panelboard or switchgear to its point of load termination.
      c. Contractor shall provide documentation of voltage drop calculations upon request of Engineer or Owner.
   2. Where multiple conductors are used in a shared raceway, conductor ratings shall be derated per the NEC.
   3. Where conductor sizes are specified in the Contract Documents, these sizes are based on copper conductors.

3.2 ALUMINUM CONDUCTORS

A. Where copper-clad aluminum, or aluminum alloy conductors are used in lieu of copper conductors, the conductor size must be adjusted to provide equal or greater ampacity of the conductor indicated. This adjustment shall be based on using the ampacity for the equivalent insulation of the conductor indicated. All conductor sizes indicated on the drawings are based on copper conductors.

B. Where copper clad Aluminum or aluminum-alloy conductors are allowed to be used, all raceways must be adjusted to accommodate increased conductor sizes.

C. Do not substitute smaller conductors with higher temperature rated insulation.

D. The smallest allowable size for aluminum conductors is 1/0. All other conductors shall be copper.

E. All conductors used for grounding electrode bonding, equipotential bonding and between wall mounted grounding buses shall be copper.

3.3 SPLICES, TAPS AND TERMINATIONS

A. Splices to feeders and service entrance conductors are not permitted unless specifically noted on the plans.

B. Electrical spring connectors shall be used for splices and taps in lighting and 120-volt receptacle circuits and motor leads #10AWG or smaller.

C. Use pressure or compression type connectors for all splices or taps in copper conductors.

D. Do not splice conductors of dissimilar metals together.

E. Use only compression type connectors for all splices, taps, and terminations using copper-clad aluminum or aluminum alloy conductors.

3.4 METAL CLAD (MC) CABLE INSTALLATION

A. MC cable will only be allowed in the applications specifically as follows in this paragraph:
   1. Individual cable drops from a junction box to light fixtures.

a. Direct fixture to fixture connections is not allowed.
b. The maximum length of cable is a 6’ connection to a light fixture.

2. Individual cable drops to ceiling mounted equipment, such as receptacles or ceiling fans.
   a. The maximum length of cable is a 4’.

B. Where MC cable is allowed to be used as specified above, the following restriction on MC cable use shall be observed. These restrictions are in addition to the requirements found in the NEC:
   1. The home runs to panel shall consist of approved conduit and wire. (Unless otherwise noted).
   2. Do not install MC cable in blocks, brick walls, and in or under concrete slabs.
   3. Do not install MC cable within or supported from a communications cable tray/ladder.
   4. Do not use MC cable in areas where cable would be exposed.
   5. Provide MC cable only above lay-in grid ceilings.
   6. Route MC cable parallel and perpendicular to building structure.
   7. All other wiring and cabling for systems shall be provided in a conduit system, unless noted otherwise in the Contract Documents.

3.5 IDENTIFICATION

A. Control circuits may be color-coded using available colors, except gray and green. They shall be identified at each terminal at the respective control panel with a label. Imprinted labels shall be protected by a heat shrinkable sleeve.

B. Each control circuit shall be identified at both ends with the same number; the wire number shall be the same as the wire number shown on the Contractor’s Equipment Drawings. Spare conductors shall also be identified.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding Electrode System

B. Equipment grounding

C. Transformer grounding.

D. Grounding of technology, security, and data rooms.

E. Bonding of new building additions

PART 2 EQUIPMENT

2.1 GROUND RODS

A. Grounding Electrode System:
   1. Provide ¾" x 10' long solid copper electrodes, where ground rods are specified.

B. Luminaire Concrete Bases:
   1. ¾" x 15' long copper weld, unless noted otherwise.

2.2 GROUNDING CONNECTORS

A. Clamps and pressure connectors.
   1. Clamps for connection to piping and conduit:
      a. Approved Manufacturer:
         1) OZ Gedney type ABG
         2) Burndy "Hyground"
         3) Thomas & Betts "Blackburn" Series.
   2. Clamps for connection to enclosures and bus work:
      a. Approved Manufacturer:
         1) OZ Gedney type KGM
         2) Burndy "Hyground"
         3) Thomas & Betts "Blackburn" Series.
   3. Bar taps for connection to bus bars which are UL listed (UL-467).
      a. Approved Manufacturer:
         1) OZ Gedney type KGM
         2) Burndy "Hyground"
         3) Thomas & Betts "Blackburn" Series.

B. Welded connections using non-reversable exothermic process:
   1. Approved Manufacturer:
      a. Cadweld
      b. Thermoweld.

2.3 WALL-MOUNTED GROUND BUSS BAR

A. Copper plate.

B. Minimum dimensions are 2” x 1/4” x 12”, unless noted otherwise.

C. Manufacturer predrilled holes, a minimum of 16, unless noted otherwise.

D. Wall mounting brackets with buss isolators.

E. Buss bar shall meet the Owner's voice/data service provider(s) requirements. Contractor shall coordinate the equipment requirements in the field with the service provider(s) and provide quantity of holes and accessory equipment as required by the service provider(s).

F. Approved Manufacturer:
   1. Hutton
   2. Alltec
   3. Or equal

PART 3 EXECUTION

3.1 INSTALLATION

A. Raceways provided for grounding electrode conductors shall be rigid nonmetallic.

B. The conductor shall be connected to the equipment ground bus or to the enclosure if there is no ground bus.

C. Separately derived systems shall be grounded in accordance with NFPA 70.

D. The grounding bushings on conduits entering distribution equipment shall be connected to the ground bus in accordance with the requirements of NFPA 70.

E. All conductors used for grounding electrode bonding, equipotential bonding and between wall mounted grounding buses shall be copper.

3.2 GROUNDING ELECTRODE SYSTEM

A. Contractor shall provide a grounding electrode system as required per NFPA 70 in addition to items noted in the Contract Documents.

B. Existing Construction (as allowed by the NEC):
   1. Provide a #3/0 conductor bonded to the metal underground water pipe. If metal water pipe is not present, drive a system of rod electrodes to satisfy the NEC requirements including Articles 250.53 and 250.56.
   2. Bond all the following building members (if present) together to form the grounding system for the building:
      a. All metal underground water pipes
      b. Metal frame of the building or structure
      c. Technology Data room grounding riser system.

C. Bond the neutral bus to the grounding electrode system at the service entrance switchboard.

3.3 EQUIPMENT GROUND

A. Solidly ground all conduit systems, switch boxes, cabinets, motor frames, switchgear, transformers, and all other permanently installed equipment to form a continuous, permanent, and effective grounding system. Bond expansion joints and metal raceway sections.

B. An equipment grounding conductor shall be installed with each conduit run or cable, including but not limited to feeder circuits, motor circuits, lighting circuits, and control circuits.

3.4 BONDING

A. Bond all systems per the NEC including raceway, cable tray, enclosures, metal piping systems, structural metal, and other items identified in the Contract Documents or the National Electrical Code.

3.5 WALL-MOUNTED GROUND BUSS BAR

A. Each ground buss bar shall be connected directly to the grounding electrode system with a #6 AWG conductor.

B. A wall mounted ground buss bar shall be provided at the following locations:
   1. Telephone service backboard.
   2. Near the electrical service entrance.
   3. In each data/technology room.

C. Contractor shall coordinate the location of each busbar with the Owner and their technology system providers before installation.

3.6 TRANSFORMER GROUNDING

A. Provide a grounding electrode conductor routed from the wye-connected secondary of the transformer (bonded to the metal enclosure) to the nearest grounding electrode:

B. Ground each transformer to the nearest grounding electrode per the NEC:
   1. Provide the neutral to ground bonding jumper at the transformer location (at the separately derived system). Verify that the neutral to grounding bond is in place prior to energizing any electronic grade TVSS panelboards.
   2. Provide grounding electrode conductor from the bonding jumper location to the grounding electrode, minimum conductor size per the NEC.
   3. The grounding electrode conductor is defined as the nearest one of the following:
      a. Effectively grounded building steel.
      b. Effectively grounded metal water pipe at the service entrance to the building.
      c. If “a” and “b” above are not available, then provide one of the following grounding electrodes:
         1) A concrete-encased electrode tied to the building footing steel reinforcing bars.
         2) Ground rod electrode.
   4. Driving a ground rod at the transformer location is not approved unless it is installed solely as a supplementary grounding electrode to one of the approved methods listed above.

3.7 SPECIAL REQUIREMENTS

A. The contractor shall determine if there are any other special grounding requirements for equipment furnished on this Project and shall provide grounding as recommended by the manufacturer.

3.8 SPLICES AND TERMINATIONS

A. In general, splices and terminations of the grounding electrode system shall be brazed, shall be exothermic welded, or shall be made with tool-compressed fittings.

B. Connections to bus bars or equipment enclosures shall be made with tool-compressed lugs which are bolted to the equipment or with bar taps.

C. Provide a #1/0 AWG (minimum) grounding conductor from each ground bar to electrical service grounding electrode.

D. Connections to ground rods shall be exothermic welded. Provide adapter sleeves as required for #6 AWG conductors or smaller.

E. Connections to copper water piping shall be made with ground clamps.

3.9 ADDITIONS TO EXISTING BUILDING

A. Bond any new additions to the existing building's grounding electrode system to ensure effective grounding for the entire building. Use #3/0 conductor, minimum.

END OF SECTION

SECTION 26 05 29

SUPPORTING DEVICES

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Manufactured Supporting Devices.

B. Fabricated Supporting Devices.

C. Installation.

1.2 DESCRIPTION OF WORK

A. Type of support hardware, anchors, sleeves, and seals specified in this section include the following:
   1. Clevis hangers
   2. Riser clamps
   3. C-clamps
   4. I-beam clamps
   5. One-hole conduit straps
   6. Two-hole conduit straps
   7. Round steel rods
   8. Expansion anchors
   9. Toggle bolts
   10. Wall and floor seals

B. Supports, anchors and sleeves furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 26 sections.

1.3 QUALITY ASSURANCE

A. Provide supporting devices, of types, sizes, and ratings required that are manufactured by firms regularly engaged in the manufacture of such devices.

B. Comply with NEC as applicable to construction and installation of electrical supporting devices.

C. Comply with applicable requirements of ANSI/NEMA std Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies".

D. Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

E. Provide electrical components which are UL-listed and labeled.

PART 2 PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

A. Provide supporting devices; complying with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for a complete installation; and as herein specified. Where more than one type of device meets indicated requirements, selection is Installers' option.

B. Provide support and anchors constructed of stainless steel, PVC, or equivalent corrosion resistant material in chemical storage rooms.

C. Structural flat surfaces:
   1. Caddy snap close clamp with z shot-fire bracket; mechanical fastener appropriate for deck type; spring steel, snap close conduit opening, static load of 100lbs or greater may be used with conduit sizes equal to and between 0.5” and 1”.
   2. Caddy bolt close clamp with z shot-fire bracket; mechanical fastener appropriate for deck type; spring steel, conduit strap with threaded openings and hex-head bolt, static load of 100lbs or greater may be used with conduit sizes equal to and between 0.5” and 1”.
   3. One-hole conduit straps for supporting metal conduit; galvanized steel may be used with conduit sizes equal to and between 0.5” and 0.75”.
   4. Two-hole conduit straps for supporting metal conduit; galvanized steel to be used with conduit sizes equal to and larger than 1”.

D. Beam flange:
   1. Caddy clip for supporting conduit to beam flanges; spring steel, snap close conduit opening, static load of 75lbs or greater may be used with conduit sizes equal to and between 0.5” and 0.75”.
   2. Beam Clamp; steel; mechanical bolt fastener to beam; conduit strap with threaded holes and hex-head bolt may be used with conduit sizes equal to and between 0.5” and 1.5”.
   3. Right angle conduit clamp: cast iron hot dipped galvanized; U-bolt with treaded ends and hex-head nuts may be used with conduit sizes equal to and between 2” and 4”.
   4. One-hole conduit straps for supporting metal conduit; galvanized steel may be used with conduit sizes equal to and between 0.5” and 0.75”.
   5. Two-hole conduit straps for supporting metal conduit; galvanized steel to be used with conduit sizes equal to and larger than 1”.

E. Rod Type Hangers:
   1. Clevis type hangers; with diameter hole for round steel rod.
   2. Hexagon nuts on both ends of rod:
      a. Conduit size 0.5"-1.5”: Minimum rod size 3/8”.
      b. Conduit size 2” to 3.5”: Minimum rod size 1/2".
      c. Conduit size 4”-5”: Minimum rod size 5/8”.
   3. C-clamps for supporting rods to beam flanges; mechanical bolt fastener.
   4. Galvanized steel for dry location inside buildings. Corrosion resistant material when used in corrosive spaces and outdoors.

F. Provide anchors of types and sizes indicated:
   1. Expansion Anchors: 1/2"
   2. Toggle Bolts: Springhead; 3/16" x 4"

G. Provide channel strut system for supporting electrical equipment, 16-gage hot dip galvanized steel, or types and sizes indicated; construct with 9/16" dia. holes, 8"o.c. on top surface, with standard green finish, and with the following fittings which mate and match with channel provided:
   1. Fixture hangers

2. Channel hangers
3. End caps
4. Beam Clamps
5. Wiring stud
6. Thin wall conduit clamps
7. Rigid conduit clamps
8. Conduit hangers
9. U-bolts

H. Roof supports
1. Cooper B-Line Dura-Blok or equal.

2.2 FABRICATED SUPPORTING DEVICES:

A. Provide sleeves of one of the following:
1. Sheet-metal fabricated from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6", 16 gage; over 6", 14 gage. Sheet metal sleeves shall not be used for cable.
2. Steel-Pipe fabricated from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron-Pipe fabricated from cast-iron or ductile-iron pipe; remove burrs.

2.3 SLEEVES, SEALS AND CAULK

A. Sleeves:
1. Conduit sleeves to be 1.5" larger than O.D. of conduit.
2. Set all sleeves true to line, grade, and position and plumb or level after concrete is poured. Correct any deviation from proper position.
3. Sleaves to be anchored to structure.

B. Seals:
1. Provide factory-assembled wall and floor seals. Provide watertight seals around conduit, pipe, or tubing passing through concrete below grad floors and wall. Construct with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
2. Subject to compliance with requirements, provide water-tight seals by:
a. Thunderline
b. Pre-approved equal.

C. Fire sealant and caulk
1. Caulk spaces between pipe and floor sleeves inside the building with a waterproof caulking material. Caulk spaces between pipe and exterior partition sleeves with glass fiber insulation.
2. Furnish sealable penetration pockets compatible with the building roofing system where conduits pass through the roof. Turn pockets over to the Owner Representative.
3. Provide fire barrier sleeve seals for sleeves located in floor and firewalls. Provide approved fire barrier material.

4. Provide minimum of 4-hour fire barriers around conduit, pipe, tubing, bus ducts and cables passing through smoke and fire rated floors and walls. Fire sealant to be red when cured.
5. Subject to compliance with requirements, and if not specified elsewhere fire sealant to be:
    a. 3M CP25WP+
    b. 3M 3000WT
    c. Dow Corning Firestop 700
    d. General Electric

PART 3 EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

A. Install hanger, anchors and sleeves in accordance with manufacturer's written instructions and with recognized industry practices to ensure supporting devices comply with requirements of NECA, NEC and ANSI/NEMA. Extend sleeves 3/4" above floor surface.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Support suspended conduit runs threaded rod and galvanized conduit hangers. Attach the hanger rod to concrete structural members with malleable iron inserts, to existing or precast concrete structural members with self-drilling anchors, to structural steel with steel "C" clamps, and to wood with suitable sized lag screws and angles. Support multiple parallel conduit runs on trapeze hangers constructed of steel rod hangers and structural channel. Include three (3) nuts jam-locked, on all threaded rod hangers, to rigidly support the conduit. Install supports with maximum spacings indicated.

D. Support surface mounted conduit runs with galvanized pipe straps. Fasten pipe straps to masonry surfaces with self-drilling anchors or toggle bolts. Fasten pipe straps to wood or sheet metal surfaces with pan head sheet metal screws.

E. Support wall mounted electrical equipment on 3/4" thick C-D exterior fir plywood painted with two (2) coats of ASA-49 gray enamel.

F. Provide stainless steel screws where electrical equipment is mounted on or attached to fire treated plywood. Hold equipment away from the plywood with either plastic or stainless-steel washers or spacers.

G. Support all ceiling mounted receptacles with a listed tile bridge spanning the suspended ceiling grid, plus a 1/4" threaded rod anchored to a structurally sound member directly above the outlet box.

H. Tighten sleeve seal nuts until sealing grommet have expanded to form water-tight seal.

I. Provide finish of supporting devices in the chemical storage room as follows:
    1. Provide PVC-coated galvanized concrete inserts and pipe straps.
    2. Provide stainless steel for all bolts, nuts, washers, and screws.
    3. Provide PVC-coated individual hangers and trapeze hangers.
    4. Provide individual galvanized rods with two (2) coats of epoxy paints.

3.2 LIGHT FIXTURE SUPPORTS

A. Securely support all light fixtures directly from building structural members or 1-1/2” or larger steel ceiling framing channels. Use steel channel where it is necessary to span the building structural members for equipment support.
   1. Wood supporting members or wires will not be acceptable.
   2. Provide minimum ¼” diameter lag screws when anchoring into wood structural members. Penetrate wood structural members a minimum of 2” with all screws.
   3. Provide steel expandable type, anchors with minimum penetration of 1-1/2” when anchoring to concrete.
   4. Do not suspend any conduit, light fixtures, or ballasts from metal roof deck or from the ceiling suspension wires. Support all lay-in fixtures independent of the ceiling support system.
      a. In lay-in ceilings provide fastening clips on each corner of each fixture.
      b. Where fixture suspension wires are required, wires shall be fastened to a structural member directly above or no greater than a 5-degree angle from the light fixture corner of which it is fastened to.
      c. Fixture suspension wires shall be provided so that fixture is not allowed to drop more than 1” if ceiling would happen to collapse.

B. Equip all fixtures using conduit stems with ball swivel hangers. In finished areas, provide canopies for the hangers.

C. Support all surface mounted fixtures with a minimum of one hanger per fixture plus one per row. Support individual fixtures with a minimum of two hangers. Attach fixture hangers to the ceiling grid per code.

D. Support all suspended fixtures with a minimum of two fixture hangers. Attach each hangar to a dedicated anchor. Locate hangars directly above the corners of the light fixtures.

3.3 ROOF SUPPORT FOR CONDUIT RACKS

A. Roof mounted conduits are to be avoided where at all possible. Contractor shall coordinate proposed roof mounted conduit routes with Engineer and Architect to verify other routes are not feasible prior to installation.

B. Provide Dura-Blok rooftop supports at a minimum of 10’o.c. or per manufacturer’s recommendations.

END OF SECTION

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SECTION 26 05 33

RACEWAYS, FITTINGS AND BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes
   1. Conduit.
   2. Conduit fittings.
   3. Conduit accessories
   4. Underground warning tape.
   5. Pull and junction boxes.
   6. Fire stop material.
   7. Handholes.
   8. Conduit Identification.
   9. Execution/Installation.

1.2 REFERENCES

A. Section 07 84 00: Firestopping.

B. Section 26 05 00: Common Work Results for Electrical

C. Section 26 05 26: Grounding and Bonding for Electrical Systems

D. Section 26 05 29: Supporting Devices

E. Section 26 27 26: Wiring Devices

F. Section 33 05 05: Trenching and Backfilling.

1.3 SUBMITTALS

A. Submit shop drawings and descriptive data in accordance with Section 26 05 00 in addition to the requirements of this section.

B. Precast concrete:
   1. Submit a coordinated set of shop drawings with the precast manufacturer, which indicates electrical box locations, cabinet locations, and conduit routing locations.

PART 2 PRODUCTS

2.1 STEEL RIGID METAL CONDUIT (RMC) AND FITTINGS.

A. Provide hot-dip galvanized or electro-galvanized (inside and outside) conduit having a bichromate finish conforming to UL standard UL-6.

B. Provide zinc coated, threaded type fittings, couplings, and bushings.

2.2 PVC-COATED STEEL RIGID METAL CONDUIT (RMC) AND FITTINGS.

A. Compliance with ANSI C80.1, ETL PVC-001, NEMA RN 1, and UL 6.

B. Hot dip galvanized or electro-galvanized rigid steel conduit.

C. 40 mil. PVC coated inside surface and outside surface.

D. Provide threaded type fittings, couplings, and bushings with the same coating as the conduit.

E. A "PVC Coated Sealing Locknut" shall be used on all exposed male threads transitioning into female NPT threads which do not have sealing sleeves, including transitions from PVC couplings/female adapters to PVC coated GRC elbows in direct burial applications. "PVC Coated Sealing Locknuts" are not to be used in place of a conduit hub.

F. Fittings shall be Form 8 with a V-Seal tongue-in-groove gasket and supplied with plastic encapsulated stainless steel cover screws. Form 8 fittings shall be UL Type 4X listed and IEC IP69 certified. Fittings shall be from the same manufacturer as the conduit to maintain system continuity and warranty. PVC Coated fittings for hazardous locations must be UL 1203 listed after the coating is applied and have a red metal tag attached to the fitting to signify compliance.

G. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes with PVC touch-up compound after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer. All installers shall be certified by the manufacturer and be able to present a valid unexpired installer certification card prior to installation beginning.

H. Provide brush-on PVC touch-up compound.

2.3 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS.

A. Provide hot-dip galvanized steel conduit conforming to UL Standard 1242 and Federal Specification WW-C-581E.

B. Provide zinc coated, threaded type fittings, couplings, and bushings.

2.4 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS.

A. Electro-galvanized tubing that meets UL Standard UL797, with the interior having a smooth coating of aluminum lacquer or enamel.

B. Do not thread tubing.

C. Provide concrete-tight steel compression or set-screw type fittings. Cast or indentor type fittings are not acceptable.

2.5 RIGID NON-METALLIC CONDUIT (RNMC) AND FITTINGS.

A. Schedule 40/80 polyvinyl chloride (PVC) rigid plastic conduit conforming to NEMA Specifications TC-2.

B. Provide plastic fittings, couplings, and bushings per manufacturer's recommendations for rigid non-metallic conduit, designed for use with solvent cement.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) AND FITTINGS.

A. Metallic conduit covered with an extruded, polyvinyl chloride sheath.

B. Provide steel or malleable iron, water-tight type fittings, couplings, and bushings approved for use with liquid-tight flexible metal conduit. Cast type devices are not acceptable.

2.7 FLEXIBLE METAL CONDUIT (FMC) AND FITTINGS.

A. Hot-dip galvanized tubing conforming to U.L. Standard ULI.

B. Provide steel or malleable iron type fittings, couplings, and bushings. Cast type devices are not acceptable.

2.8 HAZARDOUS LOCATION FLEXIBLE CONDUIT/FITTINGS

A. Flexible conduit system comprised of metallic braid.

B. No bonding jumpers required.

C. Manufacturer installed connections/fittings at both ends.

D. Stainless Steel

E. Rated for Class 1, Division 1 and II, Group D locations.

F. Manufacturer:
   1. Crouse-Hinds EC series.
   2. Or Equal.

2.9 COPPER METAL CLAD (MC) CABLE

A. Refer to Section 26 05 19 – 600 Volt Conductors and Cables.

2.10 SURFACE RACEWAY SYSTEM – SINGLE CHANNEL

A. Surface Metal Raceway System:
   1. Single channel, metal paintable two-piece raceway.
   2. Ivory-colored factory-painted raceway, boxes, fittings, and hardware.
   3. Matching fittings, cover plates, boxes, endcaps, connectors, and accessories to provide a complete system.
   4. Listed for the rated voltage of the wiring installed in the raceway.
   5. Paint to match adjacent wall.
   6. Approved Manufacturers:
      a. Wiremold 200/500/700 series
      b. Pre-approved equal

2.11 OUTLET AND JUNCTION BOXES

A. Galvanized code gauge metal outlet and junction boxes with screw-on covers of type, shape and size listed for each application.

B. Gasketed covers in damp and dusty locations, and where required to meet the listed use (i.e. wet locations).

C. Cast metal boxes (FS and FD) for all locations where IMC and RMC is used.

D. Minimum trade size of four inch (4") square boxes for all outlet and junction boxes. Provide appropriate mud rings, tile rings or raised covers, depending on the application and allowable installation.

E. Box Depths:
   1. Minimum of three and one-half inch (3½”) deep boxes when installed in masonry, including precast construction.
   2. Minimum of two and one-eighth inch (2⅛”) deep boxes when installed in non-masonry locations.

3. Shallower boxes (1½", 1¼") are allowed only at locations where the wall cavity depth does not permit deeper boxes to be installed concealed within the wall.
4. Coordinate wall thickness and materials of construction with all trades.

F. Refer to other sections for additional outlet box requirements specific to other systems.

G. Provide boxes with the appropriate size and quantity of conduit knock outs. Knock outs may be pulled out or reamed out to larger sizes on most steel boxes per manufacturer installation requirements.

H. Approved steel box manufacturers:
1. Raco
2. Steel City
3. Pre-approved equal

I. Approved cast metal box manufacturers
1. Appleton
2. Crouse-Hinds
3. Killark
4. Bell
5. Red Dot
6. Pre-approved equal.

J. Chemical Rooms:
1. Boxes in chemical rooms shall be non-metallic FS or FD boxes.
2. Weatherproof die-cast aluminum boxes with threaded outlets for all surface mounted outlets; Bell (Raco) or approved equal.

2.12 INTERIOR PULLBOXES

A. Listed metal boxes with removeable screw-on covers.

B. Boxes with a dimension larger than 12" shall have a cover attached with hinges and stainless-steel screws located within 1/2 inch of each corner opposite the hinges and spaced not more than 12 inches apart.

C. Size boxes to adhere to the NEC.

D. Enclosures to be NEMA rated that meets or exceeds the environment in which they are installed.

E. Approved manufacturers:
1. Hoffman Enclosures
2. Electro Mechanical Industries (EMI)
3. American Midwest Power (AMP)
4. Pre-approved equal.

2.13 EXTERIOR IN-GROUND HAND HOLES

A. Precast concrete box and cover or fiber reinforced polyester box and polymer concrete cover.
1. Covers and boxes design/test load rating (lbs.):
a. Grass/landscaping areas: 5,000/7,500lbs – ANSI Tier 5
b. Sidewalks and in areas of vehicle traffic: 22,500/33,750 lbs.– ANSI Tier 22

B. A minimum of 2 stainless steel bolts to secure cover to the box.

C. Sized as Required Per Code:
   1. Minimum Size 13 inches wide, 24 inches long, and 36 inches deep.

D. For fiber optic conduit runs, the word “FIBER” shall be formed on the cover.

E. When mounted in a pavement/paver/concrete surface, provide tinted cover to match the surrounding surface.

F. Approved Manufacturers:
   1. CDR Systems Corp.
   2. Quazite “Composite”
   3. Newbasis.
   4. Approved equal.

2.14 FLOOR BOXES

A. Four-Compartment Recessed Service Floor Box:
   1. Manufactured from stamped steel approved for use with floor type application.
   2. Where boxes are to be installed at polished concrete or terrazzo floors, boxes shall have the ability to accept a component that will allow the box to be installed in such material.
   3. Box minimum dimensions shall be 12-1/16” L x 9-3/16” W x 5-15/16” H with a polyester based backed white enamel finished interior.
   4. Boxes with four (4) independent wiring compartments that allow for up to four (4) receptacles, communication and/or audio/video services.
   5. Boxes shall have the ability to expand to five (5) independent wiring compartments by changing out the mounting brackets module.
   6. Boxes shall accept standard size single gang (2-3/4” x 4-1/2”), double gang (4-9/16” x 4-1/2”), and triple gang (6-3/8” x 4-1/2”) wall plates.
   7. Space or compartment in box to permit feed to adjacent compartments.
   8. Removable compartments to facilitate installation and moves, additions, and changes. The compartments to be removable from the top and back of the floor box.
   9. Two (2) cable guides to organize and maintain the cables egress out of the box.
   10. Removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through area shall be a minimum of 11-5/8 in^2. The following number of knockouts as a minimum: four (4) 3/4-inch trade size, four (4) 1-inch trade size, three (3) 1-1/4-inch trade size, and one (1) 2-inch trade size.
   11. Boxes shall be fully adjustable, accommodating a maximum 2-inch pre-concrete pour and a maximum 1/2” post-concrete pour adjustment.
   12. Include mounting brackets with the boxes that will accommodate 20-amp straight blade receptacle. Boxes shall also accommodate workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.
   13. Appropriate fire rating when installed in a fire rated floor.
   14. UL Listed for scrub water exclusion.
   15. Activation Cover:
      a. Manufactured of die-cast aluminum.

b. Two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub watertightness.
c. Covers shall be 13-7/8” x 9-15/16” x 3/16”.
d. Secure the cover to the flange and enable the cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space.
e. Cover with spring-loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible without a cover or flap sticking up above the floor surface. Each of the two (2) egress openings shall have a minimum of 2-in^2, or a minimum of 4-in^2 per cover assembly.
f. Cover finish to be determined during submittal review.

16. Device Plates to be supplied for each box as a minimum:
    a. Thermoplastic device cover over each device and compartment.
    b. One (1) device cover for each type of A/V connectivity devices.
    c. Blank plates over spare compartments.
17. Approved Manufacturer:
    a. Legrand Evolution 4/5 Series
    b. Pre-approved Equal.

B. Two-Compartment Recessed Service Floor Box:
1. Manufactured from stamped steel and approved for use in application designated.
2. Two (2) independent wiring compartments that allow capacity for up to two (2) duplex receptacles, communication, and audio/video services.
3. The box shall permit tunneling from the end of the power compartment to end power compartment. Provide each of the two (2) compartments with a minimum wiring capacity of 50cu inches.
4. Two (2) compartments shall have a minimum of 3-1/2 inches [89mm] of space behind the device plates.
5. The box shall have two removable knockout plates that can be replaced with a 2-inch trade size conduit hub (2HUB).
6. The box shall be fully adjustable, providing a pre-pour adjustment, and an after-pour adjustment.
7. Appropriate fire rating when installed in a fire rated floor.
8. UL Listed for scrub water exclusion.
9. Furniture Feed Cover Assemblies:
    a. Surface style low profile cover manufactured of die-cast aluminum alloy and equipped with one (1) 3/4-inch trade size screw plug opening and one (1) concentric 2" - 1-1/4" trade size screw plug opening, one (1) 3/4" and one (1) 2" trade size conduit fittings, and an 8-degree beveled edge that meets ADA guidelines and reduces tripping hazards. The activation cover shall be 7-3/4-inch in diameter and 3/16-inch thick.
10. Activation Cover:
    a. Manufactured of die-cast aluminum.
    b. Two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub watertightness.
    c. Covers shall have a solid lid.

d. Secure the cover to the flange and enable the cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space.
e. Spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 2-in^2 or a minimum of 4-in^2 per cover assembly.
f. The cover finish shall be manufacturer standard color chosen during submittal review.

11. Device Plates to be supplied for each box as a minimum:
    a. Thermoplastic device cover over each device and compartment.
    b. One (1) device cover for each type of A/V connectivity devices.
    c. Blank plates over spare compartments.
12. Approved Manufacturer:
    a. Legrand RFB2E Series with Round Evolution Cover
    b. Approved Equal.
13. Activation Cover:
    a. Manufactured of die-cast aluminum alloy; finished in powder-coated color to be determined during submittal review. Provide with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub water tightness.
    b. Activation covers to be 9-1/4 inches in diameter.
    c. Provide cover with spring-loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible without a cover or flap sticking up above the floor surface.
14. Device Plates to be supplied for each box as a minimum:
    a. Thermoplastic device cover over each device and compartment.
    b. One (1) device cover for each type of A/V connectivity devices.
    c. Blank plates over spare compartments.
15. Approved Manufacturer:
    a. Legrand Evolution Poke-Through Series
    b. Pre-approved Equal.

C. Floor Boxes - Gymnasium
1. Designed for use to be flush mounted in wooden Gymnasium Floor.
2. UL Listed for scrub water exclusion.
3. Box:
    a. Box shall have a minimum of 43 cubic inches and shall consist of a concrete-tight stamped steel construction with 14-gauge sides and bottom and a 10-gauge steel top.
    b. Shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete and be approved for use on grade and above-grade floors.
    c. Twelve combination 1" and 1 1/4" concentric trade size, four combination 3/4" and 1" concentric trade size.
    d. External pre-pour adjustment shall be provided by at least 2" leveling screws.
    e. Recessed/flush wood floor trim.
4. Cover:

a. The cover shall be cast aluminum. Lid to be offered with solid, flush surface for tile, wood or terrazzo and an insert option for carpet inlay.
b. Egress to be provided by two 15/16" x 6-3/8" access doors. Access door is to fold under lid during cable exit for unobtrusive appearance and mechanical protection.

5. Device Plates:
   a. Provide a thermoplastic device cover over each device and compartment.
   b. Provide each box with a minimum of two device covers for MAAP devices.
   c. Provide blank plates over spare compartments.
6. Approved Manufacturer:
   a. Box: Wiremold RFB9-OG
   b. Cover: Wiremold RFB119BT
   c. Wood Floor Trim: Wiremold RFB119-SL
   d. Pre-approved equal assembly

2.15 UNDERGROUND WARNING TAPE

A. 6 inches wide, 4-mil polyethylene film.

B. Vivid, opaque, long-lasting red color with bold, black letters.

C. Lettering
   1. Top line – "...CAUTION CAUTION CAUTION..."
   2. Bottom line – "...ELECTRIC LINE BURIED BELOW..."

D. Approved Manufacturers:
   1. Seton Name Plate Corp. No. 210 ELE, EMED Co. Stock No. UT27737-6
   2. Approved Equal.

2.16 ALUMINUM THREAD COMPOUND

A. Antioxidant and anti-seize compounds.

B. Burndy Penetrox, Ideal NOALOX, Ilsco DE-OX, or equal.

2.17 DUCT SEALING COMPOUND

A. Soft, fibrous, slightly tacky, non-hardening, and easily applied by hand at all working temperatures.

B. Clean and non-staining.

C. J.M. Clipper Corp. Duxseal, O-Z/Gedney DUX, or equal.

2.18 WIREWAYS

A. NEMA 12, minimum 14-gauge steel, ANSI 61 gray enamel finish inside and out over phosphatized surfaces.

B. 14-gauge stainless steel for corrosive environments.

C. Smooth, rounded edges on all sections and fittings.

D. Hinge type with screw clamps which are galvanized or stainless steel.

E. UL listed (UL-870).

2.19 CONDUIT IDENTIFICATION

A. 3/4 Inch By 3-1/2 Inches
   1. Nylon plates.
   2. Marked in black with a marking pen specifically designed for such use.
   3. Manufacturer: Panduit MP350, or equal.

B. 2-3/8 Inches By 4-3/4 Inches
   1. Medium weight shipping tags with reinforced eyelet.
   2. Marked in black with a marking pen specifically designed for such use.
   3. Manufacturer: Dennison Size 5, Grade G, or equal

C. Tag Protection
   1. Adhesive-backed plastic or clear polyester film tape.
   2. Manufacturer: 3M Scotch Brand 3750 Clear Box Sealing Tape, or equal.

PART 3 EXECUTION

3.1 CONDUIT SIZES

A. Verify conduit sizes indicated on the Contract Documents prior to installation. Provide proper size conduit based on the NEC maximum fill requirements, including any derating factors. Where conduit sizes are indicated on the plans, it is a minimum size allowed. It is the Contractor's responsibility to provide the proper conduit size, including any grounding conductors and flexible connections to equipment.

B. Where conduit sizes are not shown, provide conduit with the minimum sizes:
   1. 1.25" conduit for underground
   2. 3/4" conduit size for branch circuit homeruns
   3. 1/2" conduit size everywhere else.

C. Spare conduits shall be sized as noted in the Contract Documents. Where spare conduit sizes are not identified provide a minimum size of 1.25".

3.2 INSTALLATION

A. Installation of conduit shall meet the requirements of the NEC and the National Electrical Contractors Association (NECA) conduit installation standards. Where the documents may conflict, the requirements of the NEC take precedence.

B. Install all line voltage (120, 208, 277 and 480 volts) conductors in a continuous raceway system.

C. Circuits of different voltage systems shall be installed in separate raceways, unless specifically noted otherwise in the Contract Documents.

D. Provide pull and junction boxes as required by the NEC and as site pulling requirements dictate.

E. Conduits entering boxes and equipment from a flat surface shall be provided with an offset 3" from the box to allow the conduit to be fastened securely to the flat surface it is run on.

F. Do not route any conduits across rooftops, unless specifically noted otherwise in the Contract Documents to do so. Where conduits are allowed to be routed across rooftops, install conductors in Rigid Metal Conduit and provide proper derating of the conductor ampacities to account for the high ambient temperature as required in NEC. Mount conduit on roof blocks specifically designed for the intended environment.

G. Support all trapezes and all above-ground conduits from the building structure.

H. Route all horizontal raceway above water piping, where possible.

I. Do not support conduit with wire, nylon ties, nor perforated pipe straps. Remove wire used for temporary support.

J. Do not attach conduit to ceiling support wires.

K. Run all exposed conduit in a neat, workmanlike manner parallel to the building lines, tight to the wall and ceiling surfaces, and firmly support with conduit clamps or hangers.

L. Do not run conduits in the following:
   1. Columns except feed column mounted devices.
   2. Through structural slabs, beams, or columns, unless approved by the Structural Engineer.
   3. Concrete topping.
   4. Through the same penetrations through floors and walls as mechanical piping unless noted otherwise or if approved by the Engineer.

M. Place conduits at least 8" away from all hot piping and surfaces including domestic hot water lines.
   1. Boxes shall be a minimum of 3” from any process pipes, unless noted otherwise.

N. Do not mount conduit on mechanical equipment except where necessary to connect electrical devices mounted on the equipment. Provide flexible conduit in all runs "bridging" vibration mountings.

O. Do not run conduit on or directly in front of access doors, removable panels, equipment removal spaces, control devices, or other spaces necessary for normal maintenance and repair of the equipment.

P. Install all exterior underground branch circuit conduits continuously from the source to the load. Do not install in-ground boxes as pull boxes. Oversize the conduits if required.

Q. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system. Install exterior underground conduits to drain away from the building.

R. Provide suitable fittings to accommodate expansion, contraction, and deflection where conduits cross seismic, control and expansion joints. Avoid crossing expansion joints where possible.

S. Cap or plug conduit ends during construction. Cap or plug ends of conduit that are to remain empty and make watertight. Clean and swab conduits prior to pulling in conductors.

T. Provide nylon pull string in all empty conduit with a stamped plastic label indicating future use.

U. Where conduits are stubbed out above walls for use of future or low voltage cabling, provide a bushing on the end of the conduit to protect cabling.

V. Expansion fittings shall be installed at building expansion joints and where the length of straight run requires it.

W. Underground Conduit:
   1. Underground conduit runs shall have a minimum cover of 2 feet.
   2. Conduit shall be sloped to drain to handholes or pull boxes.
   3. Rigid metal conduit shall be used for the vertical elbow and riser out of the ground.

4. Contractor shall do all trenching for underground conduit with a minimum size trench. 3 inches of sand shall be placed below and above buried conduit in trench. All fill material shall be placed in 12-inch lifts and compacted to 90-Percent Standard Proctor Density. Underground warning tape shall be laid in the trench approximately 9 inches below the surface.
5. The roadway, sidewalk, or grade beneath which conduit is routed shall be restored to its original or better condition.
    a. Provide grading, soil, and seeding or sod to restore turf to original or better conditions.
    b. Coordinate type of soil, seeding and/or sod with Owner to match existing.
6. Excavating, backfilling, and grading shall comply with Division 31.

X. Conduit installed in slabs shall conform to the following requirements:
1. Conduit shall not be tied parallel to reinforcement bars.
2. Conduit must not be tied to each other and shall be spaced a minimum of 1 1/2 inches apart and preferably 3 inches apart.
3. Whenever possible, conduit should not cross over other conduit. All crossing conduits must be reviewed and approved by the Engineer prior to placement of concrete.
4. Conduit must not be placed on top of the bottom mat of reinforcement bars. There should be a minimum of 1 inch separation from the bottom of the conduit to the top of the steel bars in the bottom mat of steel.
5. Prior to placement of the conduit, the contractor must submit an appurtenance embedment drawing that shows the proposed locations of all conduits.

Y. Conduit and Penetration Sealing:
1. Seal all conduits where they pass through exterior walls and where they enter exterior fixtures.
2. Seal all conduits where temperature differential between adjacent spaces is greater than 30 degrees Fahrenheit.
3. Seal all conduit penetrations of smoke or fire rated walls or floors with intumescent type fire barriers.
4. All conduits leaving the chemical handling rooms and other areas designated on the Drawings shall be sealed internally with duct sealing compound at the point where they leave the room.

3.3 HAZARDOUS AREAS

A. Install all conduit and raceways located in hazardous areas in accordance with National Electrical Code requirements for that classification of hazardous locations. Provide all fittings and equipment approved by the Underwriter's for this type of location.

B. Where it is necessary to install sealing fittings accessible from rooms or areas which are finished, a flush wall or ceiling outlet box is to be installed and the conduit to be sealed run straight through the box with the sealing fitting occurring within the outlet box. Cover the box with a blank plate.

3.4 OUTLET AND JUNCTION BOX INSTALLATION

A. Maintain accessibility to all outlet and junction boxes as required by the NEC.

B. Provide recessed outlet boxes in all new construction, except mechanical and electrical rooms. Outlet boxes in mechanical and electrical rooms may be installed exposed.

C. Provide concealed junction boxes in all new construction, except mechanical and electrical rooms. Junction boxes in mechanical rooms may be installed exposed.

D. The mounting heights indicated on the drawings are from the center of the outlet box to the finished floor directly below the outlet. Exterior heights are from inside adjacent door, or if no door, from the first floor above grade, unless noted otherwise.

E. Coordinate the location of all outlets with all drawings before installation. Verify mounting heights and locations of all outlet boxes, including the following:
   1. Coordinate device locations with the Owner's final furniture plan(s) before rough-ins. It is advised for the Contractor get a final signed document stating this coordination was performed.
   2. Outlets are located on walls with baseboard radiation. Mount to the side of radiation covers.
   3. Switch boxes at doors. Verify door swings. Install switchboxes on the latch side of the door if possible.
   4. Outlet boxes at casework. Mount outlet boxes above counters and above backsplashes.
   5. Outlet boxes at undercounter refrigerators. Mount outlet boxes in the space reserved for the refrigerator.
   6. Outlet boxes for microwave units. Mount outlet boxes in the space reserved for the microwave.
   7. Outlet boxes adjacent to marker boards or other wall-hung items. Verify top edge and bottom edge of wall-hung items and mount outlets on clear wall space.

F. Do not mount boxes back-to-back or nippled together.
   1. Boxes mounted on opposite sides of a wall shall be mounted on separate studs.

G. Do not use through-wall boxes unless specifically called out on the plans.

H. Field-gangable boxes are not allowed. Provide manufactured, multi-gang boxes.

I. Provide separate switch boxes for lighting dimmer switches to maintain full dimmer rating, if derated wattage/ampere is below the designated circuit ampacity.

J. Close openings in all outlet boxes during plaster and concrete work with plain paper or slip-on plastic or metal plates.

K. Provide knockout closures to cap used knockout holes.

L. Provide FS and FD boxes in wet, damp, and exterior locations.

M. Maintain vapor barriers around boxes and/or provide suitable boxes listed for use in vapor barriers.

N. Provide air-tight seals for all boxes in air plenums that can allow air to pass through connecting conduit. Repair all damage to insulation and vapor barriers.

O. Where boxes and concrete are installed in masonry, provide listed equipment or the means acceptable to the AHJ necessary to provide concrete-tight connections and boxes required by the NEC.

P. Where receptacle and voice/data or TV boxes are to be provided accessible on the same side of a wall or surface, they shall be provided on the same stud or within 4” of each other.

3.5 INTERIOR PULLBOX INSTALLATION

A. Provide concealed pull boxes in all new construction, except mechanical and electrical rooms. Pull boxes in mechanical and electrical rooms may be installed exposed.

B. Terminate all conduits at cabinets and boxes with locknuts and bushings. Provide insulating bushings on all conduit 1” and larger.

C. Provide pull boxes in accessible locations. Provide accessibility to the pull box cover. Coordinate location of pull/junction boxes with other divisions (trades) prior to installation. Do not locate pull boxes in exposed finished spaces without the specific approval of the Owner Representative.

D. Provide ½” clear space behind boxes when mounting in wet or damp locations.

E. Boxes above ACT ceilings shall not be more than 4’ from the ceiling. Provide additional supporting hardware and stands to mount equipment if structural ceiling or supports is over 4’ from the ACT ceiling.

3.6 EXTERIOR IN-GROUND HANDHOLES

A. Reference NEC for handhole requirements and installation.

B. All handholes shall have a drain opening in bottom. Excavating handholes shall be dug at least 24 inches deeper than the depth of the bottom of the handhole and the area below the handhole shall be filled with pea gravel.

C. Handhole covers shall be bolted in place when Work is complete.

3.7 CONDUIT BODY INSTALLATION

A. Provide conduit bodies in accessible locations. Provide accessibility to the cover. Coordinate location of conduit bodies with other divisions (trades) prior to installation. Do not locate conduit bodies in exposed finished spaces without the specific approval of the Owner Representative.

3.8 SURFACE RACEWAY SYSTEM INSTALLATION

A. Coordinate frames with technology cabling installer and provide the proper frame and cover plate.

B. Provide surface raceway for lighting, power, low voltage systems and technology systems in finished areas of existing construction, or at other locations specifically called out on the plans. Surface raceways are not allowed in areas of new construction unless specifically called out on the plans.

C. Verify routing of surface raceway with the Owner Representative prior to installation. Route surface raceway orthogonal to building lines.

D. Provide the shortest lengths of surface raceway possible, following building lines. Route raceway into accessible ceiling space and/or accessible tunnel space.

E. Unless specifically sized on the plans, use the smallest (cross-sectional area) size raceway for the use or number of conductors installed in the raceway.

F. Provide bushing on raceways stubbed into ceiling spaces for technology cabling.

G. Do not route surface raceway through walls or floors.

H. Use manufacturer's base and cover cutter to make field cuts to the raceway.

I. Ground and bond all metal raceways.

3.9 OPENINGS

A. Contractor shall review the size and location of all openings to be sure they meet the requirements of the equipment that is furnished and/or installed as a part of this Contract. The contractor shall be responsible for providing all required openings necessary for a complete installation. All required openings are not shown on the Drawings.

B. All openings shall be filled with an approved sealant, caulking, or grout after the conduit or cable installation is complete.

C. Openings through grating shall have the bars of the grating banded.

D. Provide watertight seal around conduit in openings which are approved by the Owner Representative, for all roof, below grade and exterior wall penetrations.

E. Provide airtight seals for all raceway penetrating air plenums. Repair all damage to insulation and vapor barriers. Seal vapor barriers tight to conduit penetrating vapor barriers.

3.10 IDENTIFICATION

A. Provide panel and circuit number(s) identification on the cover of all junction boxes and pull boxes located in accessible areas (i.e. above accessible ceilings).

B. Provide clear, hand-printed lettering using a black permanent marker.

C. Perform stenciling after the building has been painted so that overspray from building painting does not cover up stenciling performed under this specification section. Re-label any boxes that have been painted over by the painter.

3.11 RACEWAY AND BOXES APPLICATIONS

A. Apply products as specified below, unless otherwise indicated.

B. Conceal all conduit work in new construction, except conduit and boxes installed in the following spaces may be run exposed:
   1. Mechanical
   2. Electrical
   3. Other utilitarian spaces with unfinished concrete walls and exposed ceilings.

C. Outdoors (non-corrosive):
   1. Exposed Conduit: RMC, IMC, RNMC SCH 80.
   2. Underground Conduit: RNMC SCH 40 or 80 with RMC elbows over 1", RMC PVC coated.
   3. Connection to vibrating equipment; including transformers and hydraulic, pneumatic, electric solenoid, or motor-driven equipment, chillers: LMFC
   4. Boxes and enclosures, aboveground: NEMA 3R. 4X
   5. Concealed inside exterior masonry wall: RMC, IMC

D. Under interior slabs-on-grade:
   1. RMC, RNMC SCH 40, IMC

E. Embedding in precast or poured concrete walls, ceilings, or floors:
   1. RMC, RNMC SCH 40, IMC

F. Interior (non-corrosive):
   1. Concealed in ceilings, interior walls and partitions: EMT, MC cable where allowed per the Contract Documents.
   2. Connection to vibrating equipment; including transformers and hydraulic, pneumatic, electric solenoid, or motor-driven equipment, chillers: FMC
      a. Use LFMC in damp or wet locations.
   3. Damp or wet Locations: RMC, IMC
   4. Boxes and enclosures: NEMA 250, Type 1
      a. NEMA 250, Type 4, stainless steel in damp or wet locations.
   5. Exposed, not subject to physical damage: EMT.
   6. Exposed and subject to severe physical damage: RMC, IMC
   7. Rigid steel conduit shall be used for the circuit between the well pump motor and the VFD.

G. Corrosive Areas (non-hazardous chemical rooms):
   1. PVC-coated rigid steel.
   2. Rigid aluminum.
   3. RNMC SCH 80
   4. Boxes and enclosures: NEMA 4X – SS316 or non-metallic.

H. Building interior hazardous, corrosive:
   1. PVC-coated rigid galvanized steel.
   2. Connection to vibrating equipment: PVC coated hazardous location rated flexible conduit, length shall be no longer than 28”.

I. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.12 FLOORBOX INSTALLATION

A. Install floor box so the finished face is flush with the surrounding floor. Maintain vapor barrier(s) around each floor box.
   1. Concrete that is sloped around a box will not be acceptable, box shall be flush with the specified elevation of the room floor, or as recommended by Manufacturer.

B. Provide multi-gang boxes wherever possible to accommodate all devices within an area. Maintain 24” separation from boxes if multi-ganging is not possible, or if the quantity of devices requires more gangs than are available from the floor box manufacturer.

C. Verify exact locations of floor boxes with the project representative, to ensure the boxes are at the equipment served, and to ensure accessibility.

D. Dog-house Style Service Box:
   1. Locate fittings as indicated on the drawings. Verify exact locations with the food service equipment contractor for kitchen equipment location.
   2. Provide recessed cast metal box with flat plate and 1” access hole at each service fitting location. Mount service fitting to plate using 1” threaded nipple.

3. Provide watertight connection between service fitting and flush plate installed in the floor slab. Provide caulking and/or rubber gasketing to ensure water tightness between service fitting and recessed cast box in the slab.
4. Install service fitting after floor covering or floor treatment is applied.
5. Install the fittings in accordance with the manufacturer's instructions.

E. Poke-Through Service Boxes:
1. Locate fittings as indicated on the drawings. Verify exact core drill location to adhere to the following restrictions:
2. Install poke-through between concrete re-bars. Do not cut re-bar in floor slab.
3. Install multiple poke-throughs a minimum of 24 inches apart from each other.
4. Do not install more than one poke through per 65 square feet in the same structural span unless permitted by the Structural Engineer.
5. Install poke-throughs where the junction boxes are accessible from the ceiling below.
6. Install the fittings in accordance with the manufacturer's instructions.
7. Coordinate with floor covering contractor to complete installation.

F. Provide an abandonment plug in all unused and/or abandoned holes for poke-through service fittings. In addition, furnish spare plugs to the Owner. The quantity shall not be less than two.

G. If not noted otherwise on the drawings, provide a 2" spare conduit with a nylon pull cord from each box run up the nearest wall and stubbed out above the accessible ceiling. Number of bends in the conduit shall not exceed 270 degrees and the overall length of the run shall not exceed 30'. If the stipulations cause conflict with actual project conditions, Contractor shall contact Engineer prior to installation of conduit and floor.

END OF SECTION

SECTION 26 08 00

TESTING AND COMMISIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. The requirements of this Section apply to all sections of Division 26.

B. All equipment checks, adjustments, tests, and system energization shall be performed as specified below. If any test specified will void the warranty of any equipment to be tested, the Engineer shall be notified and further instructions received before proceeding with the test.

C. When the Work is complete, a final inspection will be made and the Contractor shall demonstrate that all equipment and systems conform to the Drawings and Specifications.

1.2 QUALIFICATION OF PERSONNEL

A. All personnel responsible for testing and commissioning equipment as a part of this Project shall be specially trained for the tasks they are to perform.

B. Personnel operating test equipment shall have had previous training and experience in using the equipment and shall be thoroughly familiar with the equipment capabilities and limitations.

C. All tests shall be made by or under the direct supervision of service personnel who are trained in the application and operation of the device being tested.

D. Evidence of the experience of test personnel in the form of certificates of training or other acceptable documentation shall be made available upon request of the Engineer.

E. The Engineer and Owner reserves the right to require the Contractor to provide different test personnel if those performing the tests do not demonstrate competency in their work.

1.3 COMMISIONING (BY CONTRACTOR)

A. A 3rd party commissioning agent shall be provided under this contract. Contractor shall provide the company name and experience of the commissioning agent when the bid is submitted. If agent is not identified at the time of bid submittal, the bid may be rejected.

B. Commissioning of Electrical systems shall be performed and provided to meet the requirements of [2018 IECC - Section C408] [ASHRAE 90.1-2016 Section 9.4.3].

C. All descriptions of work specified with-in the Contract documents shall be performed by Contractor under this Contract.

D. Contractor shall make all adjustments to installed equipment as recommended by the Commissioning agent prior to completion of the project at no additional costs to the project.

E. Commissioning and recommended adjustments/modifications shall be completed prior to substantial completion of the project.

F. If it is found all work has not been completed Contractor shall return to the project to complete all work in the time frames identified in the Contract Documents.

G. Owner, Engineer nor Architect can be held responsible for project delays if adequate notice has not been provided or if all work has not been completed and if it is determined the Commissioning has not met the requirements set forth in this contract and final adjustments

have not been completed and the request is made to re-perform the commissioning and adjustments.

H. Contractor shall allow adequate time in the construction schedule to perform adjustments and equipment modifications as requested by the Commissioning agent.

I. Contractor is responsible for coordinating with the Construction Manager to have the building vacant of Contractors and Owner(s), except for the Contractor escorting the Commissioning Agent during the commissioning process, if required by Contractor.

J. Electrical Contractor shall provide staff whom is knowledgeable of the lighting control systems to attend to the site with the Commissioning Agent. This person shall operate and modify controls as requested during the commissioning process. If Contractor representative is not present or does not have adequate knowledge of the control systems, Commissioning will end. Contractor shall work with commissioning agent to reschedule.

PART 2 PRODUCTS

2.1 MATERIALS

A. Miscellaneous testing equipment as detailed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Test the equipment and systems and demonstrate their proper operation to the Engineer.
   1. Do not test equipment until it has been fully prepared, connected, and made ready for normal operation. Repair any equipment damaged by improper operation or testing at no cost to the Owner, before final inspection and acceptance.

B. Testing equipment used for a given test shall be recommended by the manufacturer for that particular test and shall be approved by the Engineer.

C. All test equipment shall be provided by the Contractor.

D. All equipment shall be given a thorough visual inspection by the installer to detect insofar as possible any loose or erroneous connections, damaged components, the presence of foreign objects or materials, poor workmanship, incorrect rating of protective devices, or other abnormal conditions.

E. Every bolted or screwed connection or terminal shall have a torque wrench or torque screwdriver applied to assure tightness before any equipment is energized. This shall apply to both factory made and field made connections and terminations. Any problem or damage resulting from a faulty connection or termination shall be the responsibility of the Contractor.

F. Covers shall be installed on all pull boxes, junction boxes, and raceway fittings before the final inspection.

G. Refer to each section under Division 26 for additional testing requirements specific to that section.

H. Contractor shall demonstrate to the satisfaction of the Engineer that all systems are functioning as specified. Contractor shall make all adjustments necessary to obtain the proper operation of the above systems. This shall include but is not limited to adjusting limit switches and level controls; providing the necessary type and quantity of device, relay, and starter contacts; changing wire connections to device contacts; and calibrating signal devices.

3.2 SCHEDULING AND REPORTING

A. All tests shall be scheduled 48 hours in advance with the Engineer and shall be conducted in his presence or the presence of his representative upon such request. Test results shall be tabulated neatly and legibly on Contractor provided test forms. Test reports shall include the pertinent readings or observations, a description of the method used, and a list of the equipment employed.

B. If the materials or equipment fail under test, the test reports shall include the following:
   1. Pertinent readings or observations made up to the point of failure.
   2. Any abnormal readings.
   3. Any data which might indicate the cause of failure.
   4. The cause of the failure, if determined.
   5. Corrective measures taken.

C. In all cases of test failure, the Contractor shall demonstrate that the corrective measures proposed are adequate before making any repairs, adjustments, or replacements.

D. 3 copies of all test reports shall be submitted to the Engineer within 24 hours after completion of the test. In addition, 1 complete set of test reports shall be included in each Operation and Maintenance Manual.

3.3 OVERALL ELECTRICAL SYSTEM

A. Conduct voltage tests at the time of energization of the distribution system. Perform corrective measures as required.

B. Adjust all systems and leave in proper operating condition.

C. Test all wiring and leave free of defective installation and unintentional grounds.

D. Balancing Three Phase Loads:
   1. Prior to turning the building over to the Owner turn on all equipment in the building, including lighting, and measure the current drawn on each hot leg of feeder supplying each distribution panel. If the current in any one leg varies more than 5% (plus or minus) from the arithmetic average of the current in all the hot legs, reconnect the branch circuits to obtain a balanced loading.

3.4 FEEDER TESTING

A. Megger all lighting and power circuit feeders. If insulation resistance on any circuit is less than 1 megohm, such circuits are to be considered defective and must be replaced. Submit test results for each phase of each feeder from the output report files of the tester. Document all readings and submit to the Engineer.

3.5 GROUNDING ELECTRODE TESTING

A. Perform ground resistance testing in accordance with IEEE 142 at the main service grounding electrode when testing is required by the NEC.

3.6 RECEPTACLE TESTING

A. Receptacle Testing
   1. Perform visual test for integrity of each receptacle.
   2. Verify continuity of each receptacle grounding circuit.

3. Verify proper polarity of each receptacle.

B. Measure retention force of the grounding blade. Replace receptacle if force is less than 115 grams (4 ounces).

3.7 LIFE SAFETY LIGHTING SYSTEM TESTING

A. Emergency Lighting Relay Testing
   1. Test all emergency switching relays and the Lighting Control Equipment to ensure proper operation during a normal power outage. Coordinate with the generator testing.
   2. Simulate a power outage at each emergency switching relay by turning off the normal power lighting circuit and observing the operation of the relay, observe that the emergency lighting is energized in the room or area. Verify that the toggle switch in the same room or area cannot turn OFF the emergency lighting as long as the normal source is not present.
   3. Simulate a power outage at the lighting control panel(s), and observe that the emergency relays are forced ON, energizing the life safety light fixtures controlled by the lighting control panel(s).

B. Unit Battery Equipment Testing
   1. Simulate a power outage at each unit by turning off the normal power and observing the proper operation and duration of each emergency fixture.

C. Battery Ballast Testing
   1. Simulate a power outage at each fixture with battery ballasts by turning off the normal power and observing the proper operation and duration of each emergency fixture.

3.8 COMMISIONING (IF BY CONTRACTOR)

A. Provide all commissioning documents, both recommendations and final certification certifying that the installed systems meet or exceed all documented performance criteria.

B. Documents shall be provided to Engineer and Owner within 90 days of date of the certificate of occupancy is received by Owner.

END OF SECTION

SECTION 26 22 13

TRANSFORMERS

PART 1 GENERAL

1.1 SECTION SUMMARY

A. General Duty Energy Efficient Transformers.

B. Installation.

1.2 SUBMITTALS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.

B. Include outline and support point dimensions of enclosures, unit weight, voltage, kVA, impedance, loss data, efficiency (at 25, 50, 75 and 100 percent of rated load), tap configurations, insulation system type and rated temperature rise.

C. Submit certified audible sound level test reports for each size and type of transformer.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store and protect equipment in a warm, dry location with uniform temperature. Cover ventilation openings to protect from dust and water.

B. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, and snow if handled in inclement weather.

PART 2 EQUIPMENT

2.1 GENERAL PURPOSE ENERGY EFFICIENT DRY TYPE TRANSFORMERS

A. Provide ventilated, indoor, dry-type distribution transformer with the capacity and voltage characteristics indicated on the Drawings. Provide transformers 15 kVA and above designed to operate with a maximum 115°C rise Temperature rise above 40°C ambient under full load. Provide all insulating materials for a 220°C. insulation system.

B. Provide transformers meeting or exceeding NEMA Premium efficiency requirements.

C. Energy Star Labeled.

D. Provide continuous copper coil conductors with brazed or welded terminations.

E. Isolate transformer core and coil from the enclosure using vibration - absorbing mounts.

F. Provide transformers 75 kVA or less with enclosures suitable for wall, floor or trapeze mounting. Provide transformers larger than 75 kVA with enclosures suitable for floor or trapeze mounting.

G. Acceptable manufacturers:
   1. Cutler Hammer
   2. General Electric
   3. Sola Hevi-Duty
   4. Siemens
   5. Square D

6. Power Smiths
7. MGM Transformer Company
8. Pre-approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide all brackets, hangers, and trapezes required to mount the unit. Support all suspended and all bracket mounted units from the building structure. Coordinate strength of wall for all wall mounted units. Refer to Section 26 05 29: “Supporting Devices” for additional requirements.

B. Place all transformers on elastomer isolator pads.

C. Make all connections to transformer using flexible conduit and maintain grounding continuity.

D. Provide terminal lugs listed for use with conductors rated 75° or higher.

E. Do not obstruct transformer ventilation openings nor mount within 12" of a roof deck. Maintain at least 12” space around transformer, or more if recommended in the manufacturer’s installation instructions.

F. Provide grounding of the transformer per Section 26 05 26: “Grounding and Bonding for Electrical Systems”.

G. Provide concrete pad for all floor-mounted transformers.

H. Line side disconnect/overcurrent protection device shall be lockable in closed position.

3.2 IDENTIFICATION

A. Provide permanently installed nameplates on each transformer which identifies the transformer per the Contract Documents.

B. Where the line side disconnecting means is not located within sight and within 50’, contractor shall provide a self-adhesive label on the transformer identifying the location of the disconnect.

3.3 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

3.4 WARRANTY

A. Provide one (1) year warranty on standard transformers.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Distribution panelboards

B. Lighting and appliance panelboards.

C. Installation.

D. Identification.

1.2 SUBMITTALS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.

B. Drawings submitted for approval of panelboards shall include the following information as applicable to each piece of equipment:
   1. Detailed top, front, and end views.
   2. Outline dimensions, including weights.
   3. Isometric or equivalent single line bussing diagram showing sizes, material, plating, and rating of phase, neutral, and ground buses.
   4. Electrical line diagrams and schematics.
   5. Metering and other wiring diagrams.
   6. Component device and material lists.
   7. Cutsheets for each individual breaker, fuse, compartment, and accessory.
   8. Nameplate entries and schedules.
   9. Features and accessories furnished to meet Specification requirements.
   10. Cable access and exit areas, termination spaces, pull boxes.

C. Operation and Maintenance Manuals shall be provided for each component. These manuals shall include but shall not be limited to the following:
   1. All shop drawing submittal information updated to show as-built conditions.
   2. Outline dimension prints, including weights.
   3. List of spares recommended for stock.
   4. Description of the operation, proper maintenance, and repair of all components.
   5. Local sources of service and supply.

1.3 QUALITY ASSURANCE

A. All panelboards provided shall be of the same manufacturer.

PART 2 EQUIPMENT

2.1 LIGHTING AND APPLIANCE PANELBOARDS

A. Provide lighting and appliance panelboard assemblies adhering to the following specifications:

1. Enclosures constructed of galvanized sheet steel of thickness as required by Code, with Door in door front, complete with trim, doors, flush chrome plated cylinder lock, catch, and directory with clear plastic cover.
    a. Provide 2 keys for each panelboard.
    b. All panelboards shall be keyed alike.
2. Provide NEMA 3R enclosures for exterior locations.
3. Provide welded metal frame with plastic-covered machine typed circuit directory for each panel. Directory cards must be removeable to allow updating off-site if necessary. Permanently adhered panel directories are not allowed.
4. Compliant to the following standards: UL 50, UL 67, NEMA PB-1, NFPA 70 and Fed. Spec W-P-115C, UL 489, NEMA AB-1, Fed. Spec. W-C-375B/GEN, IEC 157-1, and BS 4752.
5. Provide 240-volt AC rated panelboards for 208/120- and 240-volt AC systems. Provide 480/277 volt rated panelboards for 480/277-volt systems.
6. Provide sub feed or feed through lugs as indicated on the plans.
7. Provide tin-plated copper bus bars or tin-plated aluminum bus bars.
8. Provide proper lugs (75° C. minimum temperature rating) and gutter space for cable size indicated on the plans.
9. Provide service entrance ratings where required.
10. Trim shall be attached directly to the box with screws; trim clamps shall not be used.
11. Ampere Interrupting Ratings: As indicated in Documents.

B. Circuit Breakers:
    1. No breaker shall be larger than 100A, except for the main breaker.
    2. Provide molded case, non-adjustable, thermal-magnetic, quick-make, quick-break bolt-on type circuit breakers. Refer to the Contract Document schedules for sizes and quantities.
    3. Provide multi-pole breakers when indicated on the schedules.
    4. Breaker handle ties on single pole breakers are not acceptable.
    5. Tandem breakers are not allowed.
    6. Provide circuit breakers with engraved ratings on the handle that are visible without removing the panel cover.
    7. Series rating of circuit breakers is not allowed.
    8. Branch mounted main breakers are not allowed.
    9. GFCI rated breakers:
        a. Class A GFCI protection, HACR rated.
        b. Sense current imbalance of 4 milliamps or greater.
        c. Ground fault sensor to trip the circuit upon current imbalance.
        d. Test pushbutton on breaker.
        e. Trip indicator.
        f. 1-pole breakers rated 15-30 amperes.
        g. 2-pole breakers rated 15-60 amperes.
    10. AFCI rated breakers:
        a. Trip indicator.
        b. HACR, SWD rated.
        c. Test pushbutton on breaker.

d. Selective arc trip sensing.

C. Acceptable Manufacturers:
1. 240 volts
a. Square D type NQOD or NF
b. Siemens type P1 series
c. Cutler Hammer Pow-R-line 1a series
d. ABB ReliaGear
e. Pre-approved equal
2. 480 volts
a. Square D type NF
b. Siemens type P1 series
c. Cutler Hammer Pow-R-line 2a series
d. ABB ReliaGear
e. Pre-approved equal

2.2 SURGE PROTECTION DEVICES

A. Refer to Specification Section 26 24 18.

2.3 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Minimum 1/8” thick laminated bakelite: White face with black lettering.

B. Engrave characters with a minimum height of 1/4".

C. Minimum plate size: 1” x 3.5”. Provide larger plate if necessary to fit all lettering on it.

PART 3 EXECUTION

3.1 INSTALLATION

A. Distribution Panelboards:
1. Mount panels and cabinets to the building structure or interior wall construction. Mount independent of conduit and raceways entering boxes.
2. Provide 1" empty conduits from each flush mounted panel. When the floor is on grade, provide three (3) conduits into the ceiling cavity above. When the floor has accessible space below, provide three (3) conduits into the ceiling space above and two (2) conduits into the accessible space below the floor. Ends shall be capped and shall be tagged at both ends with permanent tags.
3. Provide concrete housekeeping pads under all floor-mounted or free-standing distribution panelboard.
4. Provide a circuit directory completely machine typed on the interior of each panel door.

B. Lighting and Appliance Panelboards:
1. Mount panelboards and cabinets to the building structure or interior wall construction. Mount independent of conduit and raceways entering boxes.
2. Mount panelboards with topmost overcurrent device no higher than allowed by the NEC (6’-7”) above finished floor.

3. Provide 1" empty conduits from each flush mounted panelboard. When the floor is on grade, provide three (3) conduits into the ceiling cavity above. When the floor has accessible space below, provide three (3) conduits into the ceiling space above and two (2) conduits into the accessible space below the floor. Ends shall be capped and shall be tagged at both ends with permanent tags.
4. Provide each circuit in the panel(s) with a circuit number securely fastened to the breaker for identification purposes.
5. Provide a circuit directory completely machine typed on the interior of each panel door.

C. Provide HACR, GFCI and AFCI rated breakers which meet the requirements of NFPA 70 in addition to when noted on the panelboard schedules.

D. Panelboard schedule designations are as follows:
1. Blank: Not intended for use.
2. Space: Contains necessary bus and hardware for future addition of breakers.
3. Spare: Contains a complete breaker installed, size as shown on schedule.

E. Panelboard enclosures shall not be used for conductors feeding through, spliced, or tapping off to/from other enclosures or devices.

3.2 GROUNDING

A. Provide grounding per Section 26 05 26: Grounding and Bonding for Electrical Systems.

3.3 IDENTIFICATION

A. Provide signage as required by the NEC in addition to the requirements of the Contract Documents.

B. Provide identification nameplates as identified in the Contract Documents.
1. Install nameplate parallel to equipment lines.
2. Install nameplates outside covers using mechanical rivets or screws.
3. Nameplates shall be attached in such a manner to not void the equipment's 3rd party testing agency approvals.

END OF SECTION

SECTION 26 24 18

SURGE PROTECTION DEVICES

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Surge protection devices

B. Installation

1.2 DEFINITIONS

A. $I_{nominal}$: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.3 SUBMITTALS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.

B. Drawings submitted for approval of the main switchboard and the service connection and metering cabinet shall include the following information as applicable to each piece of equipment:
   1. Detailed top, front, and end views.
   2. Outline dimensions, including weights.
   3. Component device and material lists.
   4. Nameplate entries and schedules.
   5. Features and accessories furnished to meet Specification requirements.
   6. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Operation and Maintenance Manuals shall be provided for each component. These manuals shall include but shall not be limited to the following:
   1. All shop drawing submittal information updated to show as-built conditions.
   2. Outline dimension prints, including weights.
   3. List of spares recommended for stock.
   4. Description of the operation, proper maintenance, and repair of all components.
   5. Local sources of service and supply.
   6. Warranty documents and point of contact for warranty claims.

PART 2 EQUIPMENT

2.1 GENERAL REQUIRMENTS FOR ALL SURGE PROTECTION DEVICES

A. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449 latest edition, section 37. MCOV values claimed based on the component's value or on the 30-minute 115% operational voltage test, section 38 in UL1449 will not be accepted.

B. Unit shall have no more than 10% deterioration or degradation of the UL1449 latest edition Voltage Protection Rating (VPR) when exposed to a minimum of 5,000 repeated category C3 (20kV/10kA) surges. The SPD manufacturer must provide a test report validating the repetitive surge test that was performed.

C. Protection Modes UL1449 4th Edition VPR for grounded WYE/delta and High Leg Delta circuits. 3-Phase, 4 wire circuits, split phase shall be as follows and comply with test procedures outlined in UL1449 section 37.6:

SYSTEM VOLTAGE	MODE	MCOV	B3 RINGWAVE 6KV, 500A	C3 COMB. WAVE 20KV, 10KA	UL1449 VPR RATING
120/240 120/208	L-N	150	490	980	700
	L-G	150	570	980	700
	N-G	150	640	1170	700
	L-L	300	500	1600	1200
277/480	L-N	320	450	1420	1200
	L-G	320	540	1540	1200
	N-G	320	570	1600	1000
	L-L	552	530	2600	2000

D. Electrical Noise Filter: each unit shall include a high-performance EMI/RFI noise rejection filter with a maximum attenuation of 54dB per MIL-STD-220B.
   1. SPD shall include an EMI/RFI noise rejection filter for all L-N modes as well as a removable filter in the N-G mode.

E. The UL1449 Voltage Protective Rating (VPR) shall be permanently affixed to the SPD unit.

F. The UL1449 Nominal Discharge Surge Current Rating shall be 20kA.

G. The SCCR rating of the SPD shall be 200kAIC without the need for upstream over current protection.

H. SPD shall be provided in a NEMA- rated enclosure suitable for the environment of which it is to be installed.

I. Manufacturer: All devices shall be provided by one manufacturer and be subject to compliance with requirements. The listing of a manufacturer as acceptable does not imply

automatic approval. Submitted products must meet all performance parameters outlined in the specification. Provide products by one of the following:

1. ABB - Current Technology
2. ASCO
3. Liebert
4. APT
5. Pre-approved equal.

2.2 SERVICE SURGE PROTECTION DEVICE (SPD)

A. To be used at the electrical service entrance where required per the Contract Documents.

B. The system shall be constructed of a single replaceable surge module, utilizing thermally fused and protected metal oxide varistors (MOVs), surge-rated copper bussing, and capacitive filtering. The system shall be a Type 1 SPD, rated for use on service entrance without the use of a separate overcurrent protection device. SPD devices that contain multiple replaceable surge modules may be acceptable but are required to replace all surge modules should any one of them fail.

C. Minimum Single Pulse Surge Current Capacity based on ANSI/IEEE 8x20 microsecond wave shape. Surge currents shall be verified by an independent 3rd party test lab. Calculated surge ratings based on the arithmetic sum of the surge components used in the construction of the product will not be accepted.

1. 100,000 amps, L-N
2. 100,000 amps, L-G
3. 100,000 amps, N-G
4. 200,000 amps, L-L (L-N + L-G modes)

D. The unit shall be able to prevent common temporary overvoltage and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load. Limited and intermediate current TOV's, as specified in UL 1449 article 39, can be caused by a loss of the neutral conductor in a split phase or three phase power system. The available fault current will be determined by the impedance of the loads connected to the phases opposite the SPD and are typically in the range of 30A to 1000A. The Selenium elements must limit voltage to the MOV as a percentage of nominal as outlined below:

Overvoltage seen by MOV's as % of Nominal Voltage				
	Available current			
Time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

E. Integral Disconnect Switch:

1. The device shall have an NEMA compliant safety interlocked integral disconnect switch with an externally mounted manual operator.

2. The switch shall disconnect all ungrounded circuit conductors from the distribution system to enable testing and maintenance without interruption to the facility's distribution system.
3. The switch shall be rated for 600Vac.
4. The SPD device shall be tested to UL1449 latest edition listed with the integral disconnect switch and the UL1449 VPR ratings shall be provided.
5. The integral disconnect switch shall be capable of withstanding, without failure, the published maximum surge current magnitude without failure or damage to the switch.
6. The line side of the integral disconnect shall be blocked off so that when the SPD is opened there is no direct access to the voltage present on the line side of the disconnect.

F. The SPD shall be listed as Type1 SPD, suitable for use in Type1 or Type2 applications.

G. The SPD shall have the following monitoring options.
1. Time Date stamp, duration, and magnitude for the following power quality events (sags, swells, surges, dropouts, outages, THD, frequency, Volts RMS per phase)
2. SPD monitoring shall track surge protection and display it as a percentage.
3. SPD shall provide a surge counter with three categories to be defined as Low Level surge (100A-500A), Medium Level surge (500A-3,000A), High Level surge (>3,000A)
4. Remote communications via Ethernet.

H. 20-year full replacement warranty.

2.3 DOWNSTREAM SURGE PROTECTION DEVICE

A. To be used at panelboards downstream of the service entrance, where shown on in the Contract Documents.

B. The system shall be constructed of a single replaceable surge module, utilizing thermally fused and protected metal oxide varistors (MOVs), surge-rated copper bussing, and capacitive filtering. SPD devices that contain multiple replaceable surge modules may be acceptable but are required to replace all surge modules should any one of them fail.

C. Minimum Single Pulse Surge Current Capacity based on ANSI/IEEE 8x20 microsecond wave shape. Surge currents shall be verified by an independent 3rd party test lab. Calculated surge ratings based on the arithmetic sum of the surge components used in the construction of the product will not be accepted.
1. 50,000 amps, L-N
2. 50,000 amps, L-G
3. 50,000 amps, N-G
4. 100,000 amps, L-L (L-N + L-G modes)

D. Integral Disconnect Switch:
1. Where identified in the Contract Documents to have a disconnect switch, SPD shall be provided with a disconnect switch integral in its enclosure.
2. The device shall have an NEMA compliant safety interlocked integral disconnect switch with an externally mounted manual operator.
3. The switch shall disconnect all ungrounded circuit conductors from the distribution system to enable testing and maintenance without interruption to the facility's distribution system.

4. The switch shall be rated for 600Vac.
5. The SPD device shall be tested to UL1449 latest edition listed with the integral disconnect switch and the UL1449 VPR ratings shall be provided.
6. The integral disconnect switch shall be capable of withstanding, without failure, the published maximum surge current magnitude without failure or damage to the switch.
7. The line side of the integral disconnect shall be blocked off so that when the SPD is opened there is no direct access to the voltage present on the line side of the disconnect.

E. Unit may be installed on either the line or load side of the main panel disconnect, if not noted otherwise. If installed on the line side, the unit shall be installed with an integral disconnect. If installed on the load side the unit shall be installed on the largest breaker size available.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Use crimped connectors and splices only. Wire nuts are unacceptable.

B. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not exceed manufacturer's recommended lead length.

C. Do not splice and extend SPD leads unless specifically permitted by manufacturer.

D. Do not bond neutral and ground.

E. SPD shall be installed in location to minimize cable lengths. If installed lead length exceeds 5' installer shall use a low impedance (HPI) cable to reduce the lead length's effect on the installed performance of the SPD per manufacturer recommendations.

3.2 GROUNDING

A. Provide grounding per Section 26 05 26: Grounding and Bonding for Electrical Systems.

3.3 STARTUP AND TESTING

A. The SPD manufacturer's technician shall perform a system checkout and start-up in the field to assure proper installation, operation and to initiate the warranty of the system. The technician will be required to do the following:
1. Verify voltage clamping levels utilizing a diagnostic test kit, comparing factory readings to installed readings.
2. Verify N-G connection.
3. Record information to a product signature card for each product installed.

B. Complete startup checks with the assistance of a factory-authorized service representative.

C. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests and reconnect them immediately after the testing is over.

D. Energize SPDs after the power system has been energized, stabilized, and tested.

3.4 IDENTIFICATION

A. Provide signage as required by the NEC in addition to the requirements of the Contract Documents.

B. Provide identification nameplates as identified in the Contract Documents.
   1. Install nameplate parallel to equipment lines.
   2. Install nameplates outside covers using mechanical rivets or screws.
   3. Nameplate shall be attached in such a manner not to void the equipment's 3rd party testing agency approvals.

END OF SECTION

SECTION 26 24 19

MOTOR CONTROL

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Section includes:
   1. Motor Control Centers
   2. Full-voltage magnetic controllers.
   3. Reduced-voltage magnetic controllers.
   4. Multispeed controllers.
   5. Variable frequency drivers.
   6. Solid state reduced voltage starters.
   7. Wall mounted starters.
   8. Manual motor starters.
   9. Power Factor Correction Capacitors.
   10. Installation.

1.2 DEFINITIONS

A. BAS: Building automation system(s).

B. CPT: Control power transformer.

C. EMI: Electromagnetic interference.

D. GFCI: Ground fault circuit interrupting.

E. IGBT: Insulated-gate bipolar transistor.

F. LAN: Local area network.

G. LED: Light-emitting diode.

H. MCC: Motor-control center.

I. MCCB: Molded-case circuit breaker.

J. MCP: Motor-circuit protector.

K. NC: Normally closed.

L. NO: Normally open.

M. OCPD: Overcurrent protective device.

N. PCC: Point of common coupling.

O. PID: Control action, proportional plus integral plus derivative.

P. PT: Potential transformer.

Q. PWM: Pulse-width modulated.

R. RFI: Radio-frequency interference.

S. SCR: Silicon-controlled rectifier.

T. TDD: Total demand (harmonic current) distortion.

U. THD(V): Total harmonic voltage demand.

V. SPD: Surge Protection Device

W. VFC: Variable-frequency motor controller.

X. VFD: Variable-Frequency Drive

1.3 SUBMITTALS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.

B. Product Data: For each type of motor controller and each type of MCC, include the following:
   1. Shipping and operating weights.
   2. Shipping splits.
   3. Dimensioned plans and elevation diagrams.
   4. Enclosure type and construction material.
   5. Electrical ratings; Voltage, Current, and KAIC rating.
   6. Conductor lug size ratings.
   7. Conduit entry locations.
   8. Schematic wiring diagrams that show power, signal, and control wiring for each installed controller.
   9. Factory installed devices.
   10. Nameplate legends.
   11. Furnished specialties and accessories.
   12. System and operating description.
   13. Parts list.
   14. Local sources of supply and service.

C. Manufacturers Installation Instructions:
   1. Include documents with shipment.

D. Spare Parts:
   1. Provide a list of recommended spare parts with unit prices.
   2. Provide in the Operation and Maintenance Manual.

E. Coordination Drawings:
   1. Provide where free standing equipment and MCC's are to be provided.
   2. Provide floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around MCCs where pipe and ducts are prohibited.
      a. Show MCC layout and relationships between electrical components and adjacent structural and mechanical elements.
      b. Show support locations, type of support, and weight on each support. Indicate field measurements.
   3. Show dimensions of housekeeping pad.

F. Operation and Maintenance Manual:

1. Shall meet the requirements of Division 1 and Section 26 05 00.
2. Operating instructions for equipment.
3. Wiring and installation instructions for equipment.
4. Settings, adjustments, and calibrations for equipment as required.
5. Recommended maintenance schedules and procedures for equipment.
6. Equipment manufacturer's name, address, and telephone number.
7. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
8. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.
9. Sample of special warranty offered by Manufacturer, Supplier or Contractor, if any.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain motor controllers of a single type from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. Manufacturer of the equipment shall have 2 stocking distributors of spare parts located within the 150 miles of the project site.

1.5 COORDINATION

A. Coordinate features of equipment, and accessory devices with remote pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each controller and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

C. The contractor shall verify that the equipment being furnished can be installed in the available space. If available space is not adequate for the proposed equipment, Contractor shall notify the Engineer before releasing the equipment for manufacturing. The contractor shall be responsible for correcting equipment spacing conflicts which were not identified and coordinated with Engineer prior to releasing the equipment for manufacturing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in shipping splits of lengths that can be moved past obstructions in delivery paths.

B. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside enclosures, and install temporary electric heating, with at least 250W per vertical section or connect factory-installed space heaters to a temporary electrical service as required to protect equipment from freezing and/or condensation.

PART 2 PRODUCTS

2.1 MOTOR STARTERS

A. General Characteristics:
   1. The starter contactors are manufactured to NEMA standards.
      a. NEMA-sized IEC devices not acceptable.
   2. NEMA 1 minimum starter size.
   3. Fault current withstand rating equivalent to rating of horizontal main bus.
   4. Line plug-in, pull-out, lock-out type.
      a. Provide guides in structure for supporting and aligning starter during removal or replacement.
      b. Tin-plated, pressure-type high strength copper stab assembly for connection to vertical bus.
      c. Lock-out latch to padlock unit in “pull-out” position and isolate entire unit from bus.
   5. Coil:
      a. 120 volts, 60 HZ.
      b. Molded construction.
   6. Control power transformer mounted in each starter operating at other than 120V single-phase.
      a. Size transformer with an extra 50VA capacity.
      b. Two primary fuses, and a single secondary fuse.
      c. Where the control voltage is used for motor protection circuits, the control power circuit shall be run through an auxiliary contact on the motor’s local disconnect device to discontinue control power when the disconnect switch is in the open position.
   7. Lugs between contactor and overload relays for connection of power factor correction capacitors.
   8. Auxiliary Contacts:
      a. Minimum of 2 N.O. field convertible auxiliary contacts per starter.
      b. Minimum of 1 N.O. field convertible auxiliary contact per overload relay.
      c. Minimum of 1 N.O. field convertible auxiliary contact per cubicle breaker/disconnect.
   9. Features:
      a. Provide control devices, relays, and contacts to perform the operations as specified in the Contract Documents.
      b. At a minimum provide the following on the enclosure door, unless specified otherwise in the contract documents:
         1) HAND-OFF-AUTO (HOA) selector switch
         2) Run (green) pilot light.
         3) Failed (red) pilot light.
         4) Required (amber) pilot light.
         5) Run time meter.

B. Overload Relay:
   1. NEMA ICS; three-phase bimetal with external manual reset.
   2. Class protection as recommended by the manufacturer of the motor it is protecting.
   3. Coordinate size with actual motor full load current.

C. Combination Full-Voltage Non-Reversing (FVNR) and Reversing (FVR) Magnetic Motor Starters:
   1. Full voltage, across the line, electrically held.
   2. Comply with NEMA ICS 2, general purpose, Class A.
   3. Line-voltage, magnetic starter with overload element and lockable motor circuit protector installed in common plug-in unit for control of induction motors.
   4. Motor circuit protector breaker with lockable handle.

D. Combination Reduced Voltage Non-Reversing (RVNR) Magnetic Controllers:
   1. Reduced voltage electrically held.
   2. Comply with NEMA ICS 2, general purpose, Class A.
   3. Closed transition, adjustable time delay on transition.
   4. Magnetic starter with overload elements and lockable motor circuit protector installed in common plug-in unit for control of induction motors.
   5. Configuration:
      a. Wye-Delta Controller: Four contactors, with a three-phase starting resistor/reactor bank.
      b. Part-Winding Controller: Separate START and RUN contactors, field-selectable for one-half or two-thirds winding start mode, with either six- or nine-lead motors; with separate overload relays for starting and running sequences.
      c. Autotransformer Reduced-Voltage Controller: Medium-duty service, with integral overtemperature protection; taps for starting at 50, 65, and 80 percent of line voltage; two START and one RUN contactors.

E. Multispeed Magnetic Controllers:
   1. Comply with NEMA ICS 2, general purpose, Class A.
   2. Two speeds, full voltage, across the line, electrically held. Compelling relay to ensure that motor will start only at low speed.
   3. Magnetic starter with overload elements and lockable motor circuit protector installed in common plug-in unit for control of induction motors.
   4. Configuration:
      a. Compelling relays ensure that the motor starts only at low speed.
      b. Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.
      c. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
      d. Anti-plugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.

F. Disconnecting Means and OCPDs:
   1. MCP Disconnecting Means:
      a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
      b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
      c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.

d. Auxiliary contact that operates only when MCP has tripped.
e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.

2. Fusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate fuses.
      1) Fuse type as recommended by manufacturer appropriate for the motor application.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.

2.2 WALL MOUNTED MAGENTIC STARTERS

A. In accordance with the applicable requirements of the Motor Starters paragraph above.

B. Provide combination type with non-fusible disconnect switch, unless noted otherwise.

C. NEMA rated enclosure:
1. Interior in conditioned space: NEMA 1 or NEMA 12.
2. Outside, near a water source, or unconditioned space: NEMA 3R
   a. Provide bolt-on hub kit(s) for conduit connections to maintain NEMA 3R rating.
3. Pool equipment rooms: NEMA 4X non-metallic switch enclosure for all pool equipment.
4. Corrosive areas: NEMA 4X 316 stainless steel, unless noted otherwise.
5. Class 1, Division 1, or 2 hazardous locations: NEMA 7 and listed as "Raintight".

D. UL Listed.

E. Manufacturer:
1. Allen-Bradley.
2. Cutler-Hammer.
3. Square-D.
4. Siemens.
5. Or Equal.

2.3 MANUAL MOTOR STARTERS

A. Manual starters shall be provided to control and protect 120-volt, single phase motors. They are identified on the Drawings as “MS.”

B. Starters shall be 120-volt, single pole with overload heater sized for the motor nameplate current.

C. The starter shall be mounted in a 2-gang FD box with single gang openings.

D. Cover:
1. ON-OFF operator cover.
2. Non-corrosive area.
   a. Appleton FSK-1VS, Crouse-Hinds DS199, or equal.
3. Corrosive area:
   a. Non-metallic enclosure, toggle lever operator, and threaded hubs.
   b. Crouse Hinds NFSC2, or equal.

E. Manufacturer:
   1. General Electric CR101Y.
   2. Cutler-Hammer MS.
   3. Square D FG5.
   4. Or equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive equipment with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

C. Examine enclosures before installation. Reject enclosures which are wet, moisture damaged, or mold damaged.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install equipment in accordance with the NEC, as shown on the Contract Documents, and as recommended by the manufacturer.

B. Install fuses if not factory installed.

C. Install equipment in accordance with manufacturer's instructions.

D. Remove temporary lifting eyes, channels, brackets and temporary blocking of moving parts from enclosures and components.

E. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and electronic overload relay pickup and trip ranges.

F. Adjust trip settings of circuit breakers and motor circuit protectors with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficiency motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

G. Install wiring between equipment and remote devices as specified and as required for the control specified in other sections.

H. Bundle, train, and support wiring in enclosures.

I. Manual motor starters shall be mounted near the equipment they serve where shown on the Drawings.

J. Connections and equipment settings shall be made to provide the operation specified in other specifications, including but not limited to Divisions 22 and 23.

K. Program equipment for required operational sequences, status indications, alarms, event recording, and display features.

L. After the equipment has been energized, an authorized service person with knowledge of the supplied controller, motor, and project control equipment shall perform the following:
   1. Make all final settings and parameter adjustments.
   2. Adjust controls and signals.

3.3 OVERLOAD PROTECTION

A. Before any motor is energized, Contractor shall obtain the nameplate information from the motor supplier. The nameplate current of all motors shall be recorded in the O&M manuals. Where a one-line diagram is provided, record the full load ampere rating in the space under the motor labeled as "FLA_____."

B. Overload relays shall be checked for correct class and setting in accordance with motor manufacturer’s recommendations. Class 10 overload relays shall be provided unless the motor manufacturer specifies otherwise.

C. Motor overload settings shall be in accordance with the starter manufacturer's recommendation for the given motor nameplate current, service factor and power factor correction capacitors, if provided. Contractor shall be responsible for all damage that results from improper overload protection.

D. Adjust overload relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

3.4 FIELD QUALITY CONTROL

A. Engage a representative or Contractor personnel trained on the provided equipment to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
   1. Inspect controllers, wiring, components, connections, and equipment installation.
   2. Test and adjust controllers, components, and equipment.
   3. Test continuity of each circuit.
   4. Verify that voltages at controller locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager and Owner before starting the motor(s).
   5. Test each motor for proper phase rotation.
   6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace them with new units and retest.
   7. Test and adjust controls, remote monitoring, and safety features. Replace controls and equipment that are damaged and malfunctioning.
   8. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.

C. Enclosed controllers will be considered defective if they do not pass tests and inspections.

D. Each controller shall be operated at rated load. The duration of the load test to be directed by the Engineer or Owner determined by the operating conditions of the installation.

E. Each unit with adjustable parameters shall be set to provide sufficient starting torque for the pump/motor to begin rotation when it is called for.

F. Clear events memory after final acceptance testing and prior to Substantial Completion.

G. Prepare test and inspection reports, including a signed report that identifies enclosed controllers and that describes testing results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.5 DEMONSTRATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the equipment is in good operating condition and properly performing the intended function.

3.6 TRAINING

A. Furnish the services of a competent, factory-trained engineer or technician for a 2-hour period, minimum, to instruct Owner personnel in operation and maintenance of the equipment, including review of the operation and maintenance manual, on a date requested by the Owner.

3.7 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components.

B. Provide warning signs as required by the NEC and when noted in the specifications.

C. Mark up a set of manufacturer's connection wiring diagrams with field-assigned wiring identifications and return it to manufacturer for inclusion in Record Drawings.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Lighting Control Devices.

B. Convenience receptacles.

C. Range receptacles.

D. Wall plates.

1.2 SUBMITTALS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.

B. Submittals for pre-approval shall be submitted 2 weeks prior to the bid date. Manufacturers of equipment looking for approval shall schedule a demonstration meeting at the Engineer's office to demonstrate the capabilities and quality of the devices. This meeting shall be scheduled 2 weeks prior to the bid date. Manufacturer/Contractor is responsible for scheduling around Engineer's prior engagements.

1.3 QUALITY

A. All wiring devices shall be products of the same manufacturer, unless specifically noted otherwise.

1.4 DEVICE COLORS

A. White devices for all wall mount devices.

B. Wiring devices mounted on or flush to a finished ceiling shall match the color of the ceiling.

C. Areas of New/Existing Construction:
   1. Match the color of the existing devices in the space. If multiple colors are provided in the space, match the most prominent color and face plate type.
   2. Provide red wiring devices for all wall mount devices connected to generator power.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES

A. If any additional lighting control devices are required, devices shall match existing lighting control system and shall be specified as noted below:

B. Line Voltage Switches:
   1. Heavy-duty, specification grade.
   2. Quiet, toggle type.
   3. Side and back wired.
   4. Rated 20 amperes under all loads, 1 HP at 120 volts, 2 HP at 240 volts.
   5. Single-pole, 2-pole, 3-way and/or 4-way as shown on the Drawings.
   6. Approved Manufacturers:

1) Cooper.
2) Hubbell.
3) Leviton.
4) Pass & Seymour.
5) Lutron.

C. Low Voltage Button Switch:
1. For use in spaces with automated controls such as vacancy/occupancy detection, time of day and day light controls.
2. Provide solid state, suitable for mounting behind a standard depth faceplate and for operation on common neutral circuits.
3. Suitable for single-pole, 3-way and 4-way switching.
4. Electrostatic discharge protection.
5. Two pushbuttons for the following control:
   a. On
   b. Off
6. Button function shall be identified with manufacturer engraving or similar means.
7. Luminaire compatible control signal directly proportional to the desired light levels. Signal source method and control signal shall be coordinated with the controlled luminaires.
8. Approved Manufacturers:
   a. Lutron.
   b. Leviton.
   c. Cooper/Arrow Hart.
   d. Hubbell.
   e. Or equal.

D. Low Voltage Dimmer:
1. For use in spaces with automated controls such as vacancy/occupancy detection, time of day and day light controls.
2. Solid state, suitable for mounting behind a standard depth faceplate and for operation on common neutral circuits.
3. Rated for the connected load of the light fixtures controlled by the dimmer.
4. Single-pole, 3-way or 4-way switching as identified in the Contract Documents.
5. Electrostatic discharge protection.
6. Four pushbuttons for the following control:
   a. On
   b. Off
   c. Light level (dimming) up
   d. Light level (dimming) down
7. Button function shall be identified with manufacturer engraving or similar means.
8. Preset feature to return lights to previous light level when turning the lights on.
9. 0-10 volt or luminaire compatible control signal directly proportional to the desired light levels. Signal source method and control signal shall be coordinated with the controlled luminaires.
10. Approved Manufacturers:

a. Lutron.
b. Leviton.
c. Cooper/Arrow Hart.
d. Hubbell.
e. Pre-approved equal.

E. Occupancy/Vacancy Sensors, Ceiling Mount:
1. Dual sensing technologies, including passive infrared and either ultrasonic or sound detection.
2. Dual technologies activates the sensor without erroneous activations and detection of occupancy by either technology shall hold the lights on.
3. 30-second to 30-minute adjustable time delay to turn off lights.
4. Dense, wide angle coverage pattern.
5. UL listed for use of line voltage or low voltage systems.
6. In addition to lighting control, single dry contact for use of the HVAC control system. Contact to be energized anytime the occupancy sensor senses motion. Sensors in the following rooms are to be provided with this:
   a. Classrooms
   b. Lobby
   c. Hallways
   d. Restrooms
7. Provide all power supplies, relay modules and mounting hardware per manufacturers' installation instructions.
8. Single-pole, 2-pole, 3-way and/or 4-way to perform the specified lighting control.
9. Approved Manufacturers:
   a. Watt Stopper.
   b. Sensor Switch.
   c. Leviton
   d. Lutron
   e. Cooper
   f. Hubbell.
   g. Pre-approved equal.
10. Provide all power supplies, relay modules and mounting hardware per manufacturers' installation instructions.
11. Single-pole, 2-pole, 3-way and/or 4-way to perform the specified lighting control.
12. Two pushbuttons to offer the following controls which override the sensor control:
    a. On – turns on lighting when lights are off.
    b. Off – turns off lighting when lights are on.
13. Sensing technology shall control lights after a button has been pressed. Sensor technology to control lighting (vacancy or occupancy mode) per identified in the Contract Documents
14. Provide device with multiple buttons for spaces with multilevel/step and/or multizone lighting.
15. Approved Manufacturers:
    a. Watt Stopper.

b. Sensor Switch.
c. Leviton
d. Lutron
e. Cooper
f. Hubbell.
g. Pre-approved equal.

F. Interior Daylight Control:
1. Digital photosensor which outputs an active signal proportional to sensed daylight levels.
a. A switch or contact type signal will not be allowed. Sensor must be compatible to perform the specified control functions.
2. Adjustable light sensitivity.
3. Compatible with the space lighting control devices and luminaires.
4. Time-delay activation and de-activation.

G. Exterior Photo Controls:
1. Light level selector to adjust activation.
2. Time-delay activation and de-activation.
3. Signal compatible with Exterior lighting equipment.

2.2 CONVENIENCE RECEPTACLES

A. Duplex receptacles:
1. Specification grade, 3-wire grounding type, NEMA 5-20R.
2. Side wired.
3. Rated 20 amperes, 125 volts.
4. In addition to when noted in the Contract Documents, tamper resistant devices shall be provided where required by the NEC and other governing codes.
5. Spring type grounding strap that holds mounting screws captive.
6. Approved Manufacturers:
a. Cooper.
b. Hubbell.
c. Leviton.
d. Pass & Seymour.

B. Ground Fault Circuit Interrupter Receptacles:
1. Specification grade, 3-wire grounding type, NEMA 5-20R.
2. Side wired.
3. Rated 20 amperes, 125 volts.
4. In addition to when noted in the Contract Documents, tamper resistant devices shall be provided where required by the NEC and other governing codes.
5. LED trip indicator.
6. Approved Manufacturers:
a. Cooper.
b. Hubbell.
c. Leviton.
d. Pass & Seymour.

2.3 RANGE RECEPTACLES

A. Specification grade, 3 pole, 4 wire.

B. 50 ampere, 125/250 volts, NEMA 14-50R.

C. Flush mounted.

D. Approved Manufacturers:
   1. General Electric 4181-3.
   2. Hubbell 9450.
   3. Or equal.

2.4 HAZARDOUS LOCATION DEVICES

A. Switches:
   1. Heavy duty, factory sealed, general use snap switches.
   2. UL listed for Class 1, Division 1, Group C and D hazardous locations.
   3. Approved Manufacturers:
      a. Appleton EDS.
      b. Crouse-Hinds EDS.
      c. Or equal.

B. Receptacles:
   1. 20 A, 125 to 250 Vac, 60 Hz.
   2. 2 wire, 3 pole, single gang.
   3. Aluminum receptacle housing and back box.
   4. Furnish complete with matching plug.
   5. UL listed for Class I, Division 1. Group C and D hazardous locations.
   6. Approved Manufacturers:
      a. Crouse-Hinds CPS/CPP.
      b. Killark KRS.
      c. Or equal.

2.5 COVERPLATES

A. Interior Coverplates: Provide new cover plates over all boxes with the following minimum specifications:
   1. All finished areas and unfinished areas with recessed boxes: Provide type 302 stainless steel with smooth satin finish.
   2. Unfinished areas over surface mounted boxes:
      a. Surface mounted switches and receptacles in FS or FD cast device boxes provide raised metal cover to match the surface metal box.
      b. Surface mounted switches in cast aluminum boxes shall have stainless steel cover plates with dimensions which match the box dimensions.
   3. Provide appropriate covers for special purpose receptacles.

B. Exterior Coverplates: Provide weatherproof “while in use”, cover plates for outlets and switches as indicated in the Contract Documents.
   1. Provide weatherproof boots for all drop cords as indicated in the Contract Documents.

2. Weatherproof switch cover plates: Cast aluminum or Lexan with cover and vinyl gasket for weatherproofing switch; or cast aluminum with lever and weatherproof gasket.
3. Weatherproof receptacle cover plates: Specification grade, weatherproof, cover plate, gasketed corrosion resistant hood/cover rated for extra-duty, for exterior and wet area receptacles.
4. Coverplates shall be NEMA 3R rated and shall be watertight when in use.
5. Approved manufacturers:
    a. Red Dot
    b. Leviton
    c. Pass and Seymour
    d. Pre-approved equal

C. Wall plates for switches or manual starters which serve exhaust fans shall be engraved "EXHAUST FAN" with 1/8-inch-high black letters.

D. Chemical Rooms:
1. Weatherproof covers for receptacles in chemical rooms shall have non-metallic double-lift cover plates.
2. Weatherproof covers for switches in chemical rooms shall have non-metallic toggle-switch cover plates.

2.6 OUTDOOR POWER PEDESTAL

A. Extruded aluminum body and top cap with steel base and opening for base anchors and conduit. NEMA 3R rated.
1. Manufacturer standard color samples to be provided at time submittal, color to be chosen during submittal review.

B. UL Listed.

C. Outdoor power pedestals provided with two devices.

D. Power and interior cabinet lighting prewired on same circuits.

E. Supplied with color-matched door that can be easily replaced by a color-matched locking door or a transparent door.

F. Recessed compartment which houses the devices with lockable door which slides shut to maintain the weatherproof while-in-use requirement.
1. The interior illuminates when door is open.
2. The door closes automatically to meet while-in-use requirements.
3. Door shall be keyed to an Owner's Standard.

G. To be mounted on a concrete base per manufacturer's installation instructions.

H. Approved Manufacturer:
1. Legrand Power Pedestal
2. Pre-Approved Equal.

PART 3 EXECUTION

3.1 WIRING DEVICES

A. Provide new devices for all outlets indicated. Provide individual GFCI, isolated ground and surge suppression device for each duplex receptacle in ganged outlets.

B. Wire each device by wrapping the conductors around the terminals and torquing the screw terminal tight.

C. Mount all receptacles with the ground pin on the bottom.

D. Replace all receptacles and plates that have been damaged, burned or discolored during construction, prior to Substantial Completion.

E. Install wall plates after all the painting has been completed.

F. Mount wall mounted dimmers in separate boxes from switches.

G. Test all wiring devices for continuity, proper polarity connections and grounding.

H. Switches and convenience outlets shall be provided where shown on the Drawings.

I. Mounting Heights: dimensions are to the center of the outlet box:
   1. Lighting control devices to be on the latch side of doors, located 4 feet above floor, unless noted otherwise.
      a. Door swing shall be verified with door installer before installing boxes.
   2. Exterior receptacles shall be mounted at 2 feet above grade level, unless noted otherwise.
   3. Receptacle outlets in the finished area shall be mounted 18 inches above floor, unless noted otherwise.
      a. When receptacles are to be installed on walls shared with a wall mounted radiation unit, receptacle shall be mounted so that the bottom of the receptacle box is 2” above the radiation unit.
   4. Interior surface mounted receptacles shall be mounted at 4 feet above floor level, unless noted otherwise.

J. For all receptacles to be installed above counters installed above counters or worktables shall be mounted with short dimension parallel to the floor. Contractor shall verify countertop heights before installing boxes for convenience receptacles.

K. All devices to be grounded to an equipment grounding conductor that has green insulation.

L. All switches, convenience receptacles, telephone outlets, manual starters, etc. in the finished areas shall be flush mounted. Flush boxes shall fit flush with the final finished wall in every case. Install metal box extenders and bond to the box where necessary.

M. All boxes shall be plumb.

N. Where indicated in the Contract Documents as WP, switches and receptacles shall have weatherproof cover plates.

O. All receptacles on a GFCI breaker shall be identified with laminated plastic nameplates which read: “GFCI PROTECTED.” Letters shall be 1/4-inch-high white on a red background. Feed through type GFCI receptacles which feed non-GFCI type receptacles when shown as GFCI type receptacles on the Contract Documents are not allowed, unless noted otherwise.
   1. For double-duplex and other multi-gang receptacles, one of the receptacles is to be a GFCI type receptacle and the remaining receptacles in the shared box may be fed through.

P. Contractor shall be responsible for providing GFCI and Arc fault protection where required per the NEC. Not all instances may be shown on the Contract Drawings. Protection may be

provided either via an accessible wall device or a rated breaker at the feeding panelboard. Installation of a blank wall device with protection features to feed devices without the protection features will not be allowed, unless specifically noted in the Contract Documents.

3.2 OCCUPANCY AND LIGHT LEVEL SENSORS

A. When occupancy sensors, daylight, or photocell sensors are to be used, Contractor shall provide a guarantee of sensor coverage and operation for the Contractor's proposed sensors and layout. It is the responsibility of the Contractor to work with the proposed manufacturer or product representative to determine sensor layout and quantities. The indicated sensor layout in the Contract Documents shall be revised to meet the manufacturer's recommended layout and sensor locations to achieve the guarantee of sensor coverage and operation.

B. If the Owner has a nuisance tripping problem for any lighting zone controlled by such sensor it is the Contractor's responsibility to resolve the issue. Contractors shall adjust the sensor settings such as sensitivity levels and time delays.

C. If it is determined the sensor is in a troublesome location such as mounted to close to windows, grills, HVAC equipment, fans, etc. The contractor shall move the device to a new location as recommended by the manufacturer.
   1. Occupancy/Vacancy sensors shall not be mounted 4' or closer to heaters, diffusers, air returns, and other mechanical equipment.

D. Where it is determined the quantity of supplied sensors is not sufficient, Contractor shall add additional sensors to offer the specified control without erroneous tripping, false offs or slow activations.

E. If Owner and Engineer determine the installed model or type of sensor provided is inadequate for the space usage or is unable to provide the specified control, Contractor shall replace the sensor(s) with a different model and/or manufacturer at request of Owner at no additional cost. If additional sensors are needed to provide the adequate coverage per the new manufacturer or model recommendations, Contractor shall install the additional sensors at no additional cost to Owner.

F. All sensor work shall be included in the bid/quote amounts. Contractors will not be awarded additional services to perform troubleshooting, programming, installations, repairs, relocations, etc. or any other work associated to the sensing devices in relation to delivering the specified lighting controls.

3.3 WALLBOX DIMMERS

A. Where dimmers are shown ganged with other dimmers and/or other devices, size outlet such that dimmers will not be underrated. Provide separate boxes if necessary.

3.4 COVERPLATE IDENTIFICATION

A. ¼" high engraved, black-infilled lettering laser etching engraved cover plates.
   1. This requirement is for all receptacle and lighting devices.

B. Provide identification on the plate immediately above the wiring device on the backside of the cover plate, unless noted otherwise.

C. For floor box devices, provide a thermal machine printed label on the underside of the floor box cover.

END OF SECTION

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SECTION 26 28 16

SAFETY SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Safety Switches

B. Corrosion Inhibitor

C. Installation

1.2 SUBMITTALS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.
   1. Safety Switch type, size, rating, enclosure type, switches poles, solid poles, HP rating
   2. Fuse size and type (if fused)
   3. Identification tag/nameplate

PART 2 PRODUCTS

2.1 SAFETY SWITCHES (DISCONNECT SWITCHES)

A. General requirements
   1. Provide safety switches as disconnects for all utilization equipment as indicated on the Drawings in addition to as required by the governing codes.
   2. Lockable handle with multiple hasps to allow proper lockout-tagout procedures.
   3. NEMA 12 or 13 enclosure when mounted inside.
   4. NEMA 3R enclosures when mounted outside. Provide bolt-on hub kit(s) for conduit connections in order to maintain NEMA 3R rating.
   5. NEMA 4X non-metallic KRYDON™ switch enclosure for all pool equipment.
   6. Unless specifically noted otherwise, provide 3-pole with solid neutral bus for landing line and load side neutral conductors.
   7. Provide proper size and quantity of lugs to terminate all phase conductors and neutral conductor. Neutral conductors may require more lugs, and a larger size.
   8. Interior ground lug.

B. Fused or unfused switch type:
   1. Provide heavy duty switch with quick-make, quick-break mechanism with positive interlock.
   2. Hinged door with mechanical interlock in the ON position, with defeat mechanism.
   3. Provide horsepower rated disconnects, fully rated for load-break and load-make operation.
   4. Provide service entrance rated switches where required.
   5. Approved manufacturers:
      a. Cutler-Hammer DH series
      b. General Electric TH series
      c. Siemens Type VBII series

d. Square-D Class 3110 series
e. Allen Bradley 1494 series
f. Pre-approved equal.

C. Corrosive locations:
1. NEMA 4X non-metallic enclosure.
2. Suitable for use as motor disconnect.
3. Lockout/tag out capabilities.
4. Round selector handle.
5. Approved Manufacturers:
a. Mersen.
b. Or Equal.

2.2 CORROSION INHIBITOR

A. Vapor phase corrosion inhibitor:
1. Provide 1 year of protection for the enclosure in which it is installed.
2. Approved Manufacturers:
a. Crouse-Hinds CID 101
b. Hoffman A-HCI
c. Zerust VC2
d. Or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install safety switches with operator handle no higher than 6’-7” above finished floor in front of the safety switch unless otherwise allowed by the NEC.

B. Mount safety switch as close to the equipment as possible. Provide metallic channel rack if necessary.

C. Do not install safety switches on removeable panels on the equipment served. Coordinate location of safety switches with the equipment provider prior to installing the switch.

D. Install safety switches with proper working clearances about the switch.

E. Disconnects for single-phase motors shall be manual motor starters or manual motor starting switches as specified in the Contract Documents.

3.2 IDENTIFICATION

A. Provide an engraved or laminated plastic nameplate on each switch. Label per the name of the device controlled unless noted otherwise on the plans.

Example:

AHU-1

1. Install nameplate parallel to equipment lines.
2. Install nameplates outside covers in unfinished areas by mechanical rivets.

END OF SECTION

SECTION 26 51 00

LIGHTING

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Drivers.

B. Luminaires.

C. Installation.

1.2 SUBMITTALS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Division 26.

B. Submit shop drawings in booklet form with separate sheet for each luminaire assembled in alphabetical order by 'type'. Submit manufacturer's data including dimensioned drawings and photometric data prepared by an independent nationally recognized testing lab.

C. Submit shop drawings for each ballast type and lamp as specified and/or indicated on the drawings.

D. Provide photometric data for each luminaire and a photometric analysis of each space where Contractor proposes using luminaires which is not listed in the Contract Documents, or which does not have prior approval. Contractor shall assume full responsibility for scheduling and timing for the analysis. The following information shall be displayed in the analysis and Contractor shall modify the analysis and change data used upon request from Engineer/Owner at no additional cost or project schedule change.
   1. Illumination levels in foot-candles.
   2. Analysis/Calculation grid shall be suitable for the project area to give a realistic feel for the space and shall be readable.
   3. Height of analysis/calculation surface(s) in the model.
   4. Light Loss factor for each luminaire.
   5. Initial delivered lumens for each luminaire and lamp.
   6. Statistics for each space/area: Average, Maximum, Minimum, Max/Min Ratio, Avg/Min Ratio.
   7. Where the measured light levels of the installed luminaires does not meet or exceed the Contractor's photometric analysis, Contractor shall replace luminaires with the specified luminaires or other approved luminaire which meets the proposed light levels.

E. Samples:
   1. Contractor shall upon written request by the consultant, provide samples of any custom-made components suitable for evaluation.
   2. Contractor shall upon written request by the consultant, provide samples of standard system components or software suitable for evaluation.
   3. Samples submitted in accordance with this section will be returned to the contractor following evaluation.

1.3 DESIGN CRIERIA

A. Where switching circuit designations are not identified in the Contract Documents, the area lighting system shall be controlled by the device(s) shown in the space.

B. Multiple lighting control zones in a shared space are identified in the Contract Documents with the use of switch designations.

C. The lighting control system shall be listed, approved, and comply as required with all governing energy codes and ordinances.

D. Refer to Section 26 51 13 for lighting control operations.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Provide luminaires with lamps, for each outlet specified in the Contract Documents.

B. Reference luminaire schedule in the Contract Documents.

C. Provide U.L. labeled luminaires.

D. The luminaire types required are as noted by a capital letter(s) and number(s) on the Drawings. Contractor is solely responsible for the exact quantities. Luminaire shapes shown on the Contract Documents do not necessarily equate to an exact length or quantity of luminaire; rather, the luminaire designation shown on the plans refer to the type of luminaire. It is the Contractors responsibility to provide the proper length and switching configuration in each space.

E. Provide disconnects at each luminaire as required by the NEC.

F. Unless indicated otherwise, provide color stabilized clear virgin acrylic diffusers for interior luminaires. Provide a minimum thickness of 0.156" for all troffer lenses.

G. Unless indicated otherwise, refer to architectural documents for mounting heights of wall mounted, pendant mounted or hung luminaires.

2.2 DRIVERS

A. LED Drivers:
   1. UL Class 2 power unit as per UL1310. It is also listed in the UL Sign Accessory Manual (UL SAM).
   2. Class A sound rating.
   3. Minimum operating ambient temperature of -40 degrees C.
   4. Life expectancy of 50,000 hours or greater at an average ambient temperature of ≤ 40 degrees C with use of the luminaire it is supplied with.
   5. Self-rise of 25 degrees C at maximum load in open air without heat sink.
   6. Certified by UL for use in a dry or damp location (Outdoor Type I).
   7. Tolerates sustained open circuit and short circuit output conditions without damage.
   8. Allowable case temperature up to 85 degrees C.
   9. Reduce output power to LEDs if maximum allowable case temperature is exceeded.
   10. Driver complies with governing FCC rules and regulations.
   11. Tolerate sustained open circuit and short circuit output conditions without damage and need of external fusing or trip devices.

12. Dimmable, controlled by 0-10V low voltage controller or other means compatible with lighting system controls.
13. Manufacturer shall have a 5 year history of producing LED lighting drivers for the North American market.

2.3 EXTERIOR MOTION RESPONSE

A. Where indicated in the Contract Documents exterior luminaires are to be provided with an integral motion sensor. Motion sensor shall detect motion 180° on the front side of the fixture.

B. Sensor shall detect motion at a total distance of twice the height of which the fixture is mounted. Example: A sensor provided on a fixture mounted at 20' shall cover an area 40' wide.

C. Motion detector shall be wired directly to the luminaire driver to provide the specified control.

D. Sensor shall be low profile.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide all hangers, rods, mounting brackets, supports, frames, etc. for proper and safe luminaire installation. Install all luminaires in accordance with manufacturers' recommendations and instructions. Refer to Section 26 05 29: "Supporting Devices" for approved supporting methods. Type of ceilings shall be verified so proper mounting hardware is furnished with each luminaire.
   1. In the chemical handling rooms (i.e. pool storage), areas designated to have non-metallic conduit and other areas designated on the Drawings, all hangers, fasteners, inserts, screws, etc. shall be PVC or nylon.

B. In general, luminaires shall be located where shown on the Contract Documents; however, Contractor shall check equipment locations and install luminaires so that piping, duct work, and other devices or equipment shall not interfere with the luminaire components or its performance.

C. Provide luminaires complete with all auxiliaries required for proper, safe and distortion free installation in the various ceiling constructions in which they appear. Coordinate ceiling types with the Architectural drawings and provide compatible luminaires.

D. Provide felt or fiberglass gaskets on all incandescent luminaires where necessary to prevent light leakage at the ceiling line.

E. Location of insulation above ceilings shall be verified where recessed luminaires are located. If insulation is present, Contractor shall provide IC rated luminaire or install barrier to separate luminaires from insulation per manufacturer's recommendations.

F. Where master/slave or inboard/outboard switching is indicated, provide tandem-wired ballasts between luminaires as required by the Governing Energy Code.

G. Pole erection and mounting shall be done according to pole manufacturer's recommendations.

H. A concrete base shall be provided for each outdoor luminaire, unless noted otherwise. Base types shall be provided as detailed on the Drawings.

3.2 WIRING

A. Provide grounding type connectors for all conduit and cable.

B. Provide a neutral (grounded) conductor with each switching circuit 120V (L-G) or greater.

C. Provide an insulated grounding conductor with each lighting circuit.

3.3 QUALITY CONTROL

A. At the time of substantial completion, all luminaires must be installed and lamped with new lamps. Install all luminaires complete with lenses, diffusers, reflectors, louvers, and other required accessories. Furnish a minimum of one case of replacement lamps for each type and size lamp used. Deliver replacement stock to the Owner's storage space as directed by the Owner.

B. Lenses, refractors, and glassware shall be clean and free from cracks or chips. All reflectors, shades, luminaire bodies, etc. shall be free from dents and scratches. Replace any damaged reflectors, diffusers, louvers, or other components at no expense to the Owner.

C. Clean all luminaires free of dust, fingerprints, paint, etc. All exposed tags and labels other than UL and emergency ballast identifiers shall be removed.

D. Perform aiming and adjustment of all lighting luminaires in accordance with instructions issued by the Engineer. Adjust all directional type luminaires (interior and exterior) after dark under the direction of the Architect, Engineer, and/or Owner.

E. Replace all defective ballasts within the guarantee period at no cost to the Owner.

3.4 LIGHTING REBATE PROGRAM

A. Apply the Utility energy lighting rebate to this project. Secure on behalf of the Owner the maximum rebate. Include all negotiations and substantiation required.

3.5 IDENTIFICATION

A. Lighting control components shall be identified by laminated plastic nameplates with 1/4-inch white lettering on a black background. Identify each lighting contactor based on the loads served. In addition, identify the lighting control panels as such.

B. Each interior LED luminaire shall be provided with an adhesive label on the outside of the housing but concealed from normal view, such as above an ACT ceiling, or on the driver housing. Label shall identify the following items:
   1. Date of installation
   2. Rated Lumen output
   3. Rated Color Temperature
   4. Rated input wattage

C. Each exterior LED luminaire shall be provided with an adhesive label on the outside of the housing but concealed from normal view, such as on the top side of a pole mounted fixture, ceiling, or on the driver housing.
   1. Pole Mounted Fixtures: Provide the label on the inside of the pole handhole cover.
   2. Exterior wall packs: Provide the label on the top side of the fixture.
   3. Ground mounted flood lights: Provide the label on the inside of the stanchion access cover, or if no cover is provided, provide on the bottom side of the fixture.
   4. Label shall identify the following items:
      a. Date of installation

b. Rated Lumen output
c. Rated Color Temperature
d. Rated input wattage
e. Distribution package type (example; Distribution Type: IV)

D. Refer to Section 26 27 26 – Wiring Devices for requirements for switching devices.

END OF SECTION

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SECTION 26 51 43

LIGHTING OPERATIONS

PART 1 GENERAL

1.1 SECTION SUMMARY

A. System Description

B. System Operation

C. Low Voltage Lighting Control Panels

D. Control Devices

E. Installation

1.2 REFERENCES

A. Section 26 05 00: Common Work Results for Electrical

B. Section 26 05 33: Raceways, Fitting and Boxes

C. Section 26 51 00: Lighting

D. Section 26 27 26: Wiring Devices

1.3 SUBMITTALS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.

B. Provide a complete shop drawing package of the system.

C. Provide clearly legible shop drawings.

D. Indicate short circuit current rating of all equipment.

E. Submit original prints of the manufacturer product sheets with complete technical data for each item being provided. Circle, arrow or provide other permanent marking on each data sheet to clearly indicate the specific product included in the submittal. Remove or crosshatch out any product on the data sheets not applicable to the project or not being submitted for review.

F. Submit wiring diagrams for all components including but not limited to, relay panels, relays, controls, etc.

G. Submit physical drawings of components.

H. Shop drawings not containing all the information listed above will be rejected without review.
   1. Submit original prints of the manufacturer product sheets with complete technical data for each item being provided. Circle, arrow or provide other permanent marking on each data sheet to clearly indicate the specific product included in the submittal. Remove or crosshatch out any product on the data sheets not applicable to the project or not being submitted for review.
   2. Provide a complete proposed system description.
   3. Provide single line riser diagram and floor plan depicting location of every device in the proposed system.

4. Provide diagram(s) depicting equipment mounting racks and the location of all equipment and devices to be mounted therein.
5. Provide diagram(s) depicting wall mounted equipment including the associated cable routing and power requirements.
6. Contractor shall provide equipment panel elevations for each lighting panel or lighting panel group. Elevations to indicate component layouts, cable routing and terminal blocks.
7. Contractor shall provide complete engineering drawings of all custom made components indicating all materials, gauges, dimensions, finishes and wiring diagrams.

I. Review of shop drawings does not vacate responsibility of contractor to provide a functioning system meeting the Owner's requirements.

J. Operating Manuals to be furnished as specified in Division 1, Division 26 and herein:
   1. Format:
      a. Contractor shall submit a complete system description and schematics to the Owner and Consultant in electronic form by 50% complete stage of construction. Operation and Maintenance Manuals shall be submitted to the Owner and Consultant in electronic form at 90% completion or at least one month prior to substantial completion inspection.
   2. Contents:
      a. Product data for all equipment.
      b. General Operation instructions for all functions in all rooms and combinations of rooms.
      c. Light duty maintenance troubleshooting guide.
      d. As-built drawings of the complete lighting system.
      e. Wiring table with source, destination, content, wire type and label number of as built system.
      f. Manufacturer supplied maintenance documentation including parts lists, precautionary information, maintenance procedures and warranty information.
      g. Completed Commissioning Checklists.
      h. Program data from programmable devices and equipment including all control system data and DSP data. Contractor shall provide electronic copies of all control processor programming source code which shall become property of the Owner upon system final commissioning. Source code shall not be locked or restricted in any manner.
      i. IP addressing scheme information, and firmware version data for installed hardware.
      j. Manufacturer supplied maintenance documentation including parts lists, precautionary information, maintenance procedures and warranty information.
      k. Contractor Installation Warranty, contact names, email addresses and telephone numbers.
      l. Training list of names, signatures and dates of Owner's representatives.

1.4 GENERAL SYSTEM REQUIREMENTS

A. Provide a complete lighting control system as described herein and as shown on the Contract Documents.

B. Preference of the Owner is not to have a master control system and to treat each space as a separately controlled unit.

C. As described in the Documents, the intent of the lighting control system is to salvage and reuse existing lighting control devices (i.e. occupancy/vacancy sensors, low-voltage dimming switches, emergency relays, power packs, etc.) wherever possible.

D. Multiple lighting control zones in a shared space are identified in the Contract Documents with the use of switch designations.

E. Where switching circuit designations are not identified in the Contract Documents, all luminaires in the area shall be controlled by the device(s) shown in the space.

F. Where multiple occupancy sensors are used for control in a common control zone, activity sensed by any sensor shall reset the off-time delay.

G. In zones where an occupancy sensor and manual push button is provided, the time delay off for the occupancy sensor shall turn the lights off when manual pushbutton is used to turn the lights on.

H. Contractor shall provide all equipment, work and programing required to perform the lighting control as described in the Contract Documents.

I. The lighting control system shall be listed, approved, and comply as required with all national, state and local energy codes.

J. Comply with NEC and all local and state codes as applicable to electrical wiring work.

K. If the lighting control device loses communication with the lighting control device, control module, or control system, or if a device fails, the lights in the zone shall fail to 100% on.

L. Contractor shall coordinate the light levels, time delays, time of day and all other Owner adjustable and non-adjustable preset set points with the Owner before programming begins and after the system is operational.

1.5 SYSTEM OPERATION

A. Contractor shall provide lighting controls and associated equipment, and work required to perform the lighting operations specified here-in.

B. Occupancy Control:
   1. When an occupant enters the space, the occupancy sensor(s) shall detect occupancy and automatically turn the lighting on.
   2. The occupancy sensor(s) in the space will turn the lighting off in an occupant is not detected after a preset time delay.
   3. Occupancy sensor time delay off shall be initially set at the time delays specified.
   4. Spaces which shall be provided with this control are as follows:
      a. Restrooms – 15 min.

C. Occupancy Control with Dimming:
   1. A switch or button device is to be provided in the space for manual control of the lighting.
   2. Multiple switches/buttons shall be provided in a space as shown to provide control from multiple locations and respective lighting control zone.

3. A means to control the light levels from 5% - 100% shall be provided on the control device(s) at each location. Occupant shall be able to use the lighting control devices to control the light levels (Up/Down) in the space.
4. When occupancy is sensed, the lighting in the space shall turn on.
    a. The lights will turn on to the % light level of when the lighting is turned off.
5. The occupancy sensor(s) in the space will turn the lighting off in an occupant is not detected after a preset time delay.
6. Occupant may turn the lighting off before the occupancy sensor opens the circuit by using the manual switch/button(s) used to turn on the lighting.
    a. If occupancy is sensed after the lighting was manually turned off, lighting shall turn on automatically.
7. Occupancy sensor time delay off shall be initially set at the time delays specified.
8. Spaces which shall be provided with this control and the proposed initial time delay off are as follows:
    a. Multipurpose Rooms – 30 minutes

D. Vacancy Control:
1. A switch/button is to be provided in the space for manual control of the lighting. Where a wall mounted occupancy sensor is shown, the buttons shall be provided on the sensor device.
2. Multiple switches/buttons may be provided in a space as shown to provide control from multiple locations.
3. The occupant will use the switch/button to turn the lighting on for the associated space.
4. The occupancy sensor(s) in the space will turn the lighting off in an occupant is not detected after a preset time delay.
5. Occupant may turn the lighting off before the occupancy sensor opens the circuit by using the manual switch/button(s) used to turn on the lighting.
6. If occupancy/vacancy sensor turns off the lighting, the system shall reset and will not turn on unless the manual control is used.
7. Occupancy sensor time delay off shall be initially set at the time delays specified.
8. Spaces which shall be provided with this control are as follows:
    a. Storage Rooms – 5 min.
    b. Receiving Area – 10 min.
    c. Janitor Closets/Rms – 5 min.

E. Vacancy Control with Dimming:
1. A switch or button device is to be provided in the space for manual control of the lighting. Where a wall mounted occupancy sensor is shown, the buttons shall be provided on the sensor device.
2. Multiple switches/buttons shall be provided in a space as shown to provide control from multiple locations.
3. A means to control the light levels from 5% - 100% shall be provided on the control device(s) at each location. Occupant shall be able to use the lighting control devices to control the light levels (Up/Down) in the space.
4. The occupant will use the switch/button to turn the lighting on for the associated space.

a. The lights will turn on to the % light level of when the lighting is turned off.
5. The occupancy sensor(s) in the space will turn the lighting off in an occupant is not detected after a preset time delay.
6. Occupant may turn the lighting off before the occupancy sensor opens the circuit by using the manual switch/button(s) used to turn on the lighting.
7. If occupancy/vacancy sensor turns off the lighting, the system shall reset and will not turn on unless the manual control is used.
8. Occupancy sensor time delay off shall be initially set at the time delays specified.
9. Spaces which shall be provided with this control and the proposed initial time delay off are as follows:
    a. Enclosed Offices – 30 minutes
    b. Meeting Rooms – 30 minutes
    c. Reception – 30min
    d. Wellness Rooms – 15min

F. Vestibules - Photocontrol:
1. Luminaires are to be controlled based on daylight light levels.
2. Luminaires shall turn on when daylight level drops to a preset set point as sensed by the local photocell. Luminaires shall be turned off when daylight level increase to a preset setpoint.
3. Luminaires shall turn 100% on.
4. Contractor shall verify all settings with Owner during startup and program/adjust settings accordingly.
5. Target FC Levels - 30fc

G. Manual Control:
1. A switch/button shall be provided in the space for manual control of the lighting.
2. Controls shall be independent of other lighting system controls.
3. Spaces which shall be provided with this control are as follows:
    a. Mechanical Rooms
    b. Data/Elec Rooms

H. Stairwells:
1. Luminaires shall be provided with integrated occupancy sensing devices.
2. When no occupancy is sensed luminaire shall be at 50% on. When occupancy is sensed luminaire shall be 100% on.

I. Exterior Photocontrol:
1. Utilize existing lighting exterior lighting control system to serve any new exterior luminaires including pole and wall mounted luminaires. Below is the sequence of operations that any new exterior luminaires shall follow as allowed by existing system.
    a. Luminaires shall be controlled by a combination of outdoor light level and time of day. The following shall occur in the order described below:
    b. When exterior light levels drop to a pre-programmed set point the luminaires shall turn on.
    c. At a preprogrammed time of day (night), the luminaires shall turn off.

d. At a preprogrammed time of day (night), the luminaires shall turn back on.
e. As the daylight levels rise to a pre-programmed set point, the luminaires shall turn off.
f. Operator shall be provided with an option to bypass or skip the time of night shutoff.
g. Luminaires are to be controlled based on outdoor light levels and detection of motion.
h. Luminaires shall turn on when daylight level drops to a preset set point as sensed by a central photo control.
i. Luminaires shall turn on to 50% on.
j. Each luminaire shall be provided with a local occupancy/motion sensor that shall increase the light output to 100% when occupant/motion is detected. When no occupancy/motion is detected after a preset time delay, initially set to 15minutes, the luminaire shall be dimmed back to 50%.
k. Luminaires shall be turned off when daylight level increase to a preset setpoint.
l. Contractor shall verify all settings with Owner during startup and program/adjust settings accordingly.
m. Separately controlled zones shall be:
    1) Exterior canopy lighting
    2) Exterior eve downlights
    3) Flag Lighting
    4) Bollards

J. Life Safety Operation:
1. All life safety relays shall fail closed and must revert to the closed state upon loss of normal utility power, regardless of the status of the life safety relay prior to the power outage. The relays shall remain in the closed state until normal power is restored, regardless of any inputs that may be “requesting” that the relay open.
2. After any utility power outage (momentary or long duration), all normal relays shall revert to whatever state they were in prior to the normal power outage.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all Equipment in accordance with manufacturer’s recommendations. Provide complete system as indicated on the drawings. Make all necessary wiring connections to internal/external devices.

B. Locate relay panels adjacent to panelboard as indicated on the drawings.

C. Install relays, low voltage switches and relay cabinets as indicated on the drawings. Install all relays, transformers, and rectifiers in relay cabinets.

D. Label all low voltage switch wires and corresponding relays to identify which relay(s) and switch(es) control associated rooms.

E. Where occupancy sensors are to be used, Contractor shall provide a guarantee of sensor coverage and operation for the Contractor’s proposed sensors and layout. If Owner has a

nuisance tripping problem for any lighting zone controlled by an Occupancy sensor it is the Contractor's responsibility to replace the sensor. If Owner and Engineer determine the model or type of sensor provided is inadequate for the space usage, Contractor shall replace the sensor with a different model and/or manufacturer at request of Owner at no additional cost.

F. Contractor shall hold coordination meetings with Electrical Contractor, Mechanical Systems Contractor, and Lighting Control Systems equipment provider. Meeting length and frequency shall be as required, with a minimum of one meeting between trades to ensure system equipment, locations, mounting, and cabling requirements are fully coordinated before installation begins. Contractor shall be responsible for any additional costs required to make corrections or additions in the field for a fully installed and operating system due to conflict of Contractor assumptions and/or conflict of materials provided. Contractor shall provide meeting minutes and a signed attendance sheet of the meeting upon request of Owner or an Owner representative.

3.2 IDENTIFICATION

A. Identify each wire and associated termination point on the terminal blocks. Provide a permanent labeling method. Provide identification based on the final identification/number system coordinated with the Owner. Provide as-built relay schedules in the cabinet and in the project O & M Manuals.

3.3 START-UP RESPONSIBILITY

A. The Contractor shall initiate system operation. Trained start-up personnel shall be provided on each consecutive working day until the system is fully functional and ready to start the testing phase.

B. Properly ground each piece of electronic equipment prior to applying power. Any equipment damaged due to improper ground shall be replaced by the Contractor at their expense.

C. Properly ground all shielded wire shields to the appropriate earth ground.

D. All systems, equipment, and devices shall be in full and proper adjustment and operation and properly labeled and identified.

E. All materials shall be neat, clean, and unmarred and parts securely attached.

F. All surfaces shall be restored to their original appearance and condition after installation.

G. Contractor shall notify the Owner's Representative when the start-up phase is complete, and the system is functioning as required per specifications. The Owner's Representative will then notify the Contractor when the testing phase is ready to begin.

3.4 TESTING

A. A trained technician shall be present when the system is put into service and shall certify to the Engineer/Owner that all equipment has been installed correctly and is operating properly.

B. Technician shall make all modifications necessary to obtain proper operation of the system.
   1. Verify that all wiring connections are complete and correct.
   2. After installation and before termination, all wiring and cabling shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields.
   3. Test for and eliminate ground loops that may result from use of different power sources for various components.
   4. Complete system software programming.

5. Test relays and switches after installation to confirm proper operation and confirm correct loads are recorded on directory card in each panel.

C. All functions and features to be tested as a complete system and corrections made at no cost to the Owner.

D. All devices shall be calibrated to obtain the specified function and to reach the specified foot-candle level. Where daylight harvesting is used, Contractor shall calibrate the associated photocell signal in relation to the measured foot-candle level delivered to the surface being lit.

E. Contractor shall notify the Owner's Representative when testing is complete, and the system is functioning as required per the Contract Documents. The contractor shall then coordinate with the Owner's Representative a time for the Owner's Review phase.

F. Contractor shall meet with the Owner's Representatives to review the programmed control schemes for the required operations. At this time, the Owner may desire to alter the system programming after reviewing the system. Contractor shall revise the lighting system controls as directed by the Owner's Representatives. Base bid shall include all changes to the proposed system shown on the Drawings; Owner shall not be charged additional costs for modifying the system controls or Contractor's attendance at meetings.

G. When the lighting control system revisions have been completed, Contractor shall test the system as described above. After the testing, Contractor shall notify the Owner's Representative when testing is complete, and the system is functioning as required per Owner modifications and the requirements of the Contract Documents. The contractor shall then coordinate with the Owner's Representative a time for Engineer to walk through the system and develop a punch list.

H. Upon completion of the punch list and verification that Contractor has completed all punch items, the Owner's Representative will notify the Contractor the testing phase of the project has been completed, and the Contractor is ready to start the record drawings phase of the project.

3.5 RECORD DRAWINGS

A. The Contractor shall submit the complete Record Drawings. These Drawings shall include:
   1. Installer prepared wiring diagrams, including terminal strip layout and identification, and wire termination and tagging for all conductors.
   2. Locations for all major equipment components installed under this Specification.
   3. Complete Riser diagrams.
   4. Cable logs.
   5. Contractor shall deliver the record plans to the Engineer. Upon receipt of the record plans by the Engineer and verification of the compliance with the above requirements for the record plans the Engineer will notify the contractor that the record plans phase of the project has been completed and the contractor is ready to start the system acceptance requirements phase of the project.

3.6 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance of work, the Contractor shall perform and/or deliver each of the following in the order.
   1. Contractor shall return the project site(s) after 30 days but no more than 60 days after the substantial completion date and when the lighting control system is operational and after

training has been completed. At this time Contractor shall meet with the Owner's representatives to review the programmed control schemes for the lighting system operations.

2. Owner may request revisions or additional training on the system. Contractor shall revise the programming and adjust device level setpoints as requested by the Owner. Base bid shall include all modifications to the; Owner shall not be charged additional costs for modifying the system controls or attendance at meetings.
3. Include a minimum of 8 hours for modifying system controls.

B. The Contractor shall deliver 2 complete "Systems Operation and Maintenance Manuals".

3.7 OPERATOR TRAINING

A. A minimum of 8 hours of training shall be provided. All training shall be at the project site(s).

B. Training sessions shall be a maximum duration of 4 hours and a minimum of 2 hours in a given day.
   1. Training sessions may occur on different non-continuous days.
   2. Schedule and days of training is to be determined by the Owner. Owner will not provide a schedule mapping out all training sessions, training is to be provided upon request when needed.
   3. Owner to give Contractor a minimum of 2-week notice of when a training session is required.
   4. Final day of training may occur up to 12 months after the final completion date.

C. All training hours shall be logged and signed by Contractor and Owner.

D. Items to be covered in training shall include but not be limited to:
   1. Devices.
   2. Software.
   3. Operation.
   4. Maintenance.
   5. Trouble Shooting.
   6. Equipment specifications.

E. Contractor shall provide 3 copies of a custom, project specific training manual before the initial training session. The manuals shall be bound in 3 ring binders to allow the Owner to make additional copies as required. The manual shall provide a brief project specific outline of each of the above items with basic startup and/or troubleshooting procedures for each item. Manual shall also include detailed description of operation of each piece of equipment or system in the facility.

F. Training dates shall be coordinated with the Owner 2 weeks before scheduled sessions.

G. Training time shall not be used for equipment start-up, testing and commissioning. All equipment shall be fully programmed and tested before training begins.

H. Signed copies of the training log shall be completed and submitted to the Engineer after each training session.

3.8 COMMISSIONING

A. Contractor shall return the project site(s) 6 months, but not longer than 8 months, after the final completion date. At this time Contractor shall meet with the Owner's representatives to review the programmed control schemes for the basic operations. Contractor shall revise the programming and device setpoints as requested by the Owner. Base bid shall include all modifications to the lighting control system; Owner shall not be charged additional costs for modifying the system controls or attendance at such meetings.
   1. Include a minimum of 4 hours for modifying system controls.

END OF SECTION

SECTION 26 52 00

EMERGENCY LIGHTING

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Exit Signs.

B. Vandel Guards.

C. Installation.

1.2 SHOP DRAWINGS

A. In addition to the requirements of this section, submit shop drawings and descriptive data in accordance with Division 1 and Section 26 05 00.

1.3 QUALITY CONTROL

A. Egress and emergency lighting levels shall be verified during testing by Contractor. Systems to meet minimum lighting levels required by the governing codes for a period of 90 minutes.

B. Prior to installation of exit signs and emergency egress lighting, Contractor shall contact the Building Official and Fire Marshal to arrange a walk-through to discuss exit sign and emergency lighting placement, approximately at the mid-point of construction. Contractor will be held responsible for cost to modify and/or add egress lighting and exit signs after wall and ceilings are covered.

1.4 BUILDINGS WITH PERMANENT MOUNTED GENERATOR

A. Lighting circuits tied to generator power shall be switched with the general lighting in the space unless designated as a night light in the Contract Documents.

B. Night lights, which are always on and also used as emergency and egress shall be connected directly to the emergency power source via the dedicated life safety emergency power circuits.

C. In existing buildings which emergency lighting is tied to general generator powered panels, connect indicated emergency lighting to the existing panelboard already serving the emergency systems in that area.

D. Luminaires switched by UL 924 relay control devices connected to the local switching circuit shall be labeled or provided with an indicator to indicate the use of the relay and that it is an emergency fixture. A test button or device shall be provided in an accessible location to allow the maintenance staff to test the relay device to ensure its operation.

E. Circuits used to power emergency egress equipment and exit signs shall be provided separately from the general lighting circuits per the NEC requirements.

PART 2 PRODUCTS

2.1 EXIT SIGNS

A. Provide exit signs that adhere to the following minimum specifications:
   1. 120- and 277-volt operation.
   2. Multiple LED lamp source.

3. NFPA 101 and EPA/DEP Energy Star Compliant.
4. Green or red stenciled letters (refer to light fixture schedule)
5. Universal mounting: right side (canopy), left side (canopy), top (canopy) and back.
6. Knockouts for chevrons, right and left.
7. Snap-in wiring connections to allow replacement of components without removing housing.

B. Approved Manufacturers:
1. Refer to the light fixture schedule.

2.2 VANDAL GUARDS

A. Provide vandal guards where indicated on the plans, that adhere to the following minimum specifications:
1. Separate wire guards, mounts to wall. Guards that mount directly to fixtures are not acceptable.
2. Provide guard sized to allow full aiming of heads without binding on the guard.

B. Approved Manufacturers:
1. Safety Technology International, Inc.
2. Pre-approved equal

2.3 EMERGENCY LIGHTING RELAY

A. Enclosed relay circuit which shunts ON emergency lighting circuit during loss of normal power.

B. Self-contained, rated for use in plenum space, NEMA 1 enclosure.

C. LED indicator to indicate mode of operation and available power sources.

D. Designed for switching circuit which the luminaire and relay is to be used with.

E. Relay contacts rated for 20ampere, voltage to match lighting system circuit.

F. UL 924 listed.

G. A test button shall be mounted in an accessible location to allow the Owner to test the function of the relay. If the test button is not located adjacent to the fixture, provide a nameplate identifying its function and which luminaire(s) it operates.

PART 3 EXECUTION

3.1 EMERGENCY EGRESS LIGHTING

A. Install a complete and operational emergency lighting system in accordance with NEC article 700 and Chapter 5 of NFPA 101 Life Safety Code.

B. Install equipment as recommended by the Manufacturer. Notify the Engineer of any discrepancies.

C. Route raceway down from ceiling to wall mounted devices. Minimize the use of exposed raceway routed through finished spaces.

D. Connect emergency lights to the unswitched lighting branch circuit in the area served by the unit equipment.

E. Adjust emergency fixture heads for maximum effectiveness or as directed by the Engineer or AHJ.

3.2 EXIT SIGNS

A. Provide exit signs at each exit and along the egress path.

B. Mount exit signs to walls wherever possible. Where exit signs are shown to be installed to a lay-in ceiling, provide additional support from the building structure. Refer to Section 26 05 29: Supporting Devices for supporting requirements.

3.3 VANDAL GUARDS

A. Securely mount guards to structure using standard hardware with dedicated anchors. Refer to Section 26 05 29: "Supporting Devices".

B. Provide a minimum of four anchors (1 per corner), or additional if recommended by the guard manufacturer.

3.4 WARRANTY

A. Provide a complete part and labor warranty for the system, commencing on the date of final acceptance and continuing for a period of one (1) year. Provide all materials and labor required to correct any system malfunction or failure (determined not to be the result of negligence, abuse or misuse) at no charge to the Owner during this time.

3.5 EMERGENCY LIGHTING RELAY

A. Provide wiring and controls for a complete and operating system.

B. Upon loss of normal power to the adjacent lighting circuit, relay shall bypass the room switching control and turn on luminaire.

END OF SECTION

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SECTION 27 0000 – GENERAL TECHNOLOGY REQUIREMENTS

PART 1 - GENERAL

1.01 PROJECT SUMMARY

A. Scope: Successful bidder shall provide, install, configure, and provide warranty service for technology systems described herein.

1.02 RELATED DOCUMENTS

A. Documents: Provisions of General Conditions, Supplementary Conditions, and the sections included under Procurement & Contract Requirements are included as part of this section as though bound herein.

1.03 RELATED WORK

A. Section 27 05 00 – Communications General Requirements

B. Section 27 05 26 – Grounding and Bonding for Technology Systems

C. Section 27 05 28 – Pathways for Technology Systems

D. Section 27 05 37 – Firestopping for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 13 00 – Communications Backbone Cabling

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 40 00 – AV/Multimedia General Requirements

I. Section 27 41 00 – Audio Visual Systems

J. Section 27 51 00 – Distributed Communications Systems

K. Section 27 60 00 – Physical Security General Requirements

L. Section 27 62 00 – Electronic Access Control System

M. Section 27 64 00 – Video Surveillance System

N. Section 27 66 00 – Intrusion Detection System

1.04 DEFINITIONS

A. Approved or Approval: Where approval is called for, only persons with the authorized authority may grant approval. Owner reserves all rights to govern over and grant approval and will appoint authority of agents acting on their behalf.

B. As Required: Contractor shall provide the quantity of said item that is necessary. Owner and Consultant reserve the right to make the final determination of necessary quantities to provide for a complete system.

C. Basis of Design: The documentation of the concepts, calculations, decisions, and product selections used to meet the Owner's project requirements. These Consultant produced documents are not shop drawings. Product selections depict minimum functionality and overall quality and are open to substitution requests.

D. Consultant: True North Consulting Group.

E. Contractor: The qualified party responsible to provide all items and perform services as described within these documents. The Contractor referred to within a specific specification section shall be the successful qualified party contracted to perform and complete that work.

F. Documents: The complete package of Bid and Contract Requirements, General Technology Requirements, related Division 27 sections, drawings, schedules, and addenda that make up this Request for Bid.

G. End-User: Individual(s) who will ultimately operate the completed system.

H. ETR: Existing to Remain. Item is to remain in current location and maintain current functionality.

I. Furnish: To supply and deliver to project site, ready for installation.

J. Install: To place in a position of service or use.

K. NIC: Not in Contract. Item will be the responsibility of others.

L. Notice to Proceed: Formal communication from Owner to Contractor stating the date the Contractor can begin work subject to the conditions of the contract. The performance time of the contract starts from the Notice to Proceed date.

M. OFCI: Owner Furnished Contractor Installed. Item will be provided by Owner and shall be installed by Contractor.

N. OFE: Owner Furnished Equipment. Item will be provided and integrated by Owner.

O. OFOI: Owner Furnished Owner Installed. Item will be provided and installed by Owner.

P. Owner: The party named in the Procurement and Contract Requirements as the advertising party.

Q. Provide: To furnish and install, complete and ready for intended use.

R. Substantial Completion: The stage in the progress of installation when the systems described herein are sufficiently complete, in accordance with the Contract Documents, so that the Owner can utilize such systems for their complete intended use.

S. Turnkey: Of or involving the provision of a complete product or service that is ready for immediate use.

T. Work: The provision of products and/or services to meet the requirements specified in these documents.

1.05 REFERENCE STANDARDS AND CODES

A. Standards and other procedures referenced by this bid package are as follows:

1. ADA – Americans with Disabilities Act of 2010
   www.ada.gov/2010ADAstandards_index.htm

2. AIA – American Institute of Architects
   www.aia.org

3. ANSI – American National Standards Institute
   www.ansi.org

4. ASTM – American Society of Testing and Materials
   www.astm.org

5. BICSI – Building Industry Consulting Service International, Inc.
   (RCDD Standards)
   www.bicsi.org

6. CFR – Code of Federal Regulations
   www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
   (Available from the Government Printing Office)
   (Material is usually first published in the Federal Register)

7. U.S. Copyright Law, December 2011
   www.copyright.gov/title17

8. ECIA – Electronic Components Industry Association
   ESC – EIA Standards Council
   www.eciaonline.org

9. IACS – International Annealed Copper Standard
   www.ndt-ed.org/GeneralResources/IACS/IACS.htm

10. IEC – International Electrotechnical Commission
    www.iec.ch

11. IEEE – Institute of Electrical and Electronics Engineers
    standards.ieee.org

12. ISO – International Organization for Standardization
    www.iso.org

13. ITU-T – International Telecommunication Union – Telecommunication
    www.itu.int

14. NEC – National Electrical Code (NFPA 70)
    maintained by NFPA – National Fire Protection Association
    www.nfpa.org

15. NECA – National Electrical Contractors Association
    www.necanet.org

16. NEMA – National Electrical Manufactures' Association
    www.nema.org

17. OSHA – Occupational Safety and Health Administration
    (U.S. Department of Labor, OSHA)
    www.osha.gov

18. TIA – Telecommunications Industry Association
    www.tiaonline.org/standards

19. UL – Underwriters' Laboratories
    www.ul.com

B. Standards: Referenced standards and/or procedures shall be binding on the Contractor and work shall be judged against such standards and procedures unless otherwise stated in writing.

C. Local/State Codes: Contractor shall comply with all local and state code requirements as determined by the authority having jurisdiction (AHJ).

D. Owner Standards: Contractor shall obtain and abide by all published Owner standards as they pertain to the work described herein.

E. Contractor shall use the latest versions of all standards and codes unless otherwise directed by the authority having jurisdiction (AHJ) or expressly noted herein.

1.06 QUALIFICATIONS

A. Refer to related sections for specific requirements.

1.07 PERMITS AND INSPECTIONS

A. Responsibility: Obtain permits and inspections required for the work. Contractor is responsible for all permit and inspection costs.

B. Performance: Perform tests required herein, or as may be reasonably required to demonstrate conformance with the specifications or with the requirements of any legal authority having jurisdiction.

C. Review: Obtain approvals from authorities responsible for enforcement of applicable codes and regulations to establish that the work is in compliance with all requirements of reference codes indicated herein and required by the appropriate jurisdiction. Make corrections, changes or additions as required and deliver certificates of acceptance, operation, and/or compliance with the Operation and Maintenance Manuals described herein.

1.08 DRAWINGS AND BASIS OF DESIGN

A. General: Work, equipment, or material delineated on any drawing in this package is expected to be provided by Contractor unless noted otherwise.

B. Interpretation: Work shall be installed in accordance with the basis of design diagrammatically expressed on the drawings and described in the written specifications and equipment schedule(s). Contractor shall not make limiting interpretation that provides for incomplete work or a non-functioning system.

1.09 PRODUCT SUBSTITUTION PROCEDURES

A. Requests for Substitutions: Should the Contractor request a change in the material that is to be supplied, from that which was specified in the contract, the Contractor shall provide the Owner and the Consultant with a written request for said change.

B. Substitutions for Non-specified Products: Where no product specification is provided, Contractor may use manufacturer's specification for the identified product as a guide for suggesting appropriate substitutions.

C. Requirements: The Request for Substitution shall include:

1. Reason for substitution.

2. Material data sheets for both the proposed item(s) and the item(s) to be replaced.

3. Any cost impact to the Owner.

D. Changes: Proposed changes to Contract Documents shall be clearly identified in the pre-construction submittals.

E. Approval: The Owner may approve or deny any Requests for Substitution. The Owner reserves the right to govern over and proclaim whether proposed products are equal to the specifications. The Contractor shall not procure any substitute materials until the Owner has approved and signed the Request for Substitution and passed copies to the Contractor and the Consultant. Any procurement or work performed prior to this approval is at the Contractor's own risk.

F. Deviation: Products provided or installed that deviate from the products specified in make, model, color, or other significant characteristic (i.e., non-approved substitutions) shall be removed and replaced with specified products at no additional expense to Owner.

1.10 SOFTWARE

A. Versions: Consultant used the following software versions for this project:

1. Autodesk Revit MEP 2023 (floor plans)

2. Autodesk AutoCAD MEP 2024 (detail sheets)

1.11 SUBMITTAL CONDITIONS

A. The Contractor shall not consider the Consultant or Owner's review of submittals to be exhaustive or complete in every detail. Approval of shop drawings or submittals including substitutions indicates only the acceptance of the Contractor's apparent intent to comply with general design or method of construction and quality as specified. The finished product shall meet functional requirements, operations, arrangements, and quantities and comply with the contract documents unless specifically approved otherwise.

B. The Contractor shall be held responsible for delivery of systems as specified. Any errors or omissions in the submittals shall not relieve Contractor of responsibility to deliver complete systems as specified.

1.12 PRE-CONSTRUCTION PROCEDURES

A. Pre-Construction Submittal Meeting: Contractor shall schedule web conference (Microsoft Teams or similar) with Consultant to review basis of design and submittal expectations.

B. Prior to Work: Pre-construction submittals shall be provided to Consultant with appropriate promptness as to cause no delay to the work.

C. Project Timeline: Project timeline will not be altered due to lateness of submittals. Contractor is bound to deliver a timely, complete, and finished project as stipulated in their contract and specified herein.

D. Format and Distribution: Contractor shall provide one (1) electronic copy in PDF format to Consultant of all pre-construction submittals. The Contractor shall provide hard copies sets as required up to five (5) sets.

E. Provision: Contractor shall submit pre-construction submittals including any corrections or additions to Consultant prior to the procurement of equipment or commencement of work.

F. Review: Pre-construction submittals shall be received and formally approved by Consultant prior to the procurement of material or the commencement of work. Any procurement or work performed prior to this approval is at Contractor's own risk.

G. Failure to Provide: The failure of Contractor to provide pre-construction submittals as required herein may result in the withholding of payment for work and/or the cancellation of the contract.

1.13 PRE-CONSTRUCTION SUBMITTALS

A. Pre-construction submittals are intended to document the details of installation. Exact copies of original drawings and specifications are not acceptable as pre-construction submittal drawings. Consultant schematic diagrams describe the basis of design as defined herein.

B. Contractor shall provide to Consultant the following pre-construction submittals for approval in addition to specific requirements identified in subsequent sections.

1. Qualifications: Shall include documentation of all required certifications and qualifications.

2. Shop Drawings:

a. Title: Each drawing shall have a descriptive title and all subparts of each drawing shall have unique identifiers.

b. Floor Plans: Shall include device locations, Contractor provided furniture and installation notes.

c. System Drawings: Shall include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification detail, connectors, adapters, intra/inter-rack power distribution, installation notes and any other information required to convey the complete turnkey system design.

d. Equipment Rack and Cabinet Elevations: Shall include placement of all mounted equipment.

e. Structurally Mounted Elements: Shall include both plan view of placement as well as a detail of structural mounting techniques to be used.

f. Furniture: Shall include all Contractor provided furniture showing dimensional drawings, cable management and finishes with samples for Owner approval.

3. Product Data:

a. Equipment Schedules: Shall include manufacturers, part numbers, quantities and unit pricing.

b. Product Cut Sheets: Shall identify (highlight, arrow, etc.) actual part numbers to be utilized including but not limited to equipment, mounting hardware, cabling, connectors, software and power distribution equipment.

4. Manufacturer's Recommendations:

a. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, copies of these recommendations shall be provided prior to installation. Installation of the items will not be allowed to proceed until the recommendations are received and approved.

1.14 PRE-INSTALLATION PROCEDURES

A. Refer to individual sections for additional information.

1.15 CONSTRUCTION PROGRESS PROCEDURES

A. Meeting Attendance: Contractor is required to attend job progress meetings in accordance with requirements set by Owner or Consultant.

B. Additional Coordination: Contractor shall request additional job construction coordination meetings it deems to be necessary to ensure coordination of their responsibilities with other parties.

C. Progress Inspection: Consultant may perform periodic progress inspections. At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

D. Test Plan: Ten (10) business days prior to the proposed Contractor test date, Contractor shall provide a test plan defining the tests required.

1. The test plan shall be approved by Consultant prior to any testing.

1.16 CONSTRUCTION PROGRESS SUBMITTALS

A. Completion: Contractor shall complete and submit via email all construction progress documentation in PDF format as requested by Owner and Consultant.

B. Contractor shall provide to Consultant the following construction progress submittals in addition to specific requirements identified in subsequent sections.

1. Weekly Report: Weekly written report to be submitted to Consultant through appropriate project channels in PDF format outlining progress from previous week, plans for progress in the current week, and any coordination issues that may require Consultant or Owner attention.

2. Test Plan: Shall ensure the system meets Owner operational and performance specifications and include the following:

a. Identification of the capabilities and functions to be tested.

b. Detailed instructions for the setup and execution of each test.

c. Procedures for evaluation and documentation of the results.

C. Failure to Complete: Failure to complete requested construction progress documentation may result in the withholding of payment by Owner.

1.17 CLOSEOUT PROCEDURES

A. Notification: Contractor shall provide written notification to Consultant and Owner when Contractor is satisfied that the work has reached Substantial Completion and is ready for inspection.

B. Pre-Inspection Submittals: Contractor shall submit an electronic copy of all closeout submittals to Consultant in accordance with the requirements found in these documents no less than ten (10) business days prior to the scheduled Final Inspection.

1. Test Results
2. As-built drawings (full-size sheets)
3. Operation and Maintenance Manuals
4. End User Software

C. Photos that demonstrate complete system installation.

D. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in these documents, and/or unacceptable to Consultant or Owner shall be documented by Consultant and provided to Contractor to rectify at no additional cost. Contractor shall provide written notification to Consultant and Owner when all punch list items have been completed.

E. Final Inspection: At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

F. Re-Inspection: If more than one (1) re-inspection is necessary, the costs of the additional travel, time, and expenses of Owner and Consultant may be deducted by Owner from the contract amount due to the Contractor.

G. Punch List Approval: Once all punch list items are complete, the Contractor shall return an initialed punch list to the Consultant and Owner for verification. Punch list shall be considered complete only after having been signed by Owner and Consultant.

H. Closeout Submittals: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide three (3) electronic copies to Owner and Consultant in format(s) noted below.

1. Record Drawings – AutoCAD 2020 editable .dwg format AND PDF.
2. Operation and Maintenance Manuals – USB flash drive.
3. End User Software – USB flash drive.
4. Documentation of testing and system certification.
5. Completed Minnesota Department of Revenue IC-134 Form.

I. Closeout Submittal Format and Distribution: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide one (1) digital copy with labeled bookmark dividers of all record drawings (full-size sheets) and operation and maintenance manuals,

one (1) digital copy to Consultant. Title on cover page shall be “Operation and Maintenance Manual – [Project Name]”. The following additional items shall be identified on the binder cover:

1. Client Name
2. Contractor Name and Contact Information
3. Consultant Name and Contact Information
4. Date

J. All documentation prepared by the Contractor, including hard copy and electronic forms, shall become the property of the Owner.

K. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by Owner and Consultant, including punch list(s) and/or re-inspection(s) and delivery of closeout deliverables.

1.18 CLOSEOUT SUBMITTALS

A. Closeout submittals are intended to document the details of the final installation that substantially conforms to the construction documents and functions as intended to meet the Owner’s needs.

B. Contractor shall provide to Consultant the following closeout submittals for approval in addition to specific requirements identified in subsequent sections.

1. As-built drawings: As-built drawings are prepared by the Contractor. They show, in red ink, on-site changes to the Consultant-approved pre-construction submittal documents. As-built drawings shall be submitted to Consultant for approval prior to submitting record drawings and include:
    a. Changes made by Addenda, Change Orders, Requests for Information (RFIs), Architect’s Supplemental Instruction (ASIs), or Requests for Proposal (RFPs) in addition to any other changes to the original documents.
    b. Actual device locations, conduit routing, wiring and relationships as they were constructed.
    c. Nomenclature showing as-built wire designations and colors.
    d. Room numbers coinciding with Owner space planning numbering.
2. Record drawings: Record drawings are the final drawings prepared by the Contractor and incorporate all as-built drawing changes previously approved by Consultant. Record drawings should be electronically produced without any handwritten, red ink, or clouded changes.
3. Operation and Maintenance Manuals: Notwithstanding requirements specified elsewhere, submit one (1) copy of each of the following per binder:
    a. A final Bill of Materials for each system.
    b. A Microsoft Excel (.xlsx format) spreadsheet for each device that resides on the network, provide the following:

i. IP Address

ii. MAC Address

iii. Serial Number

iv. Manufacturer

v. Model Number

vi. Device Username

vii. Device Password

viii. Telecom Closet or Rack Location

ix. Patch Panel Port Number

x. Switch Port Number

xi. Any other relevant information as requested by Owner

c. Manufacturers Instruction Manuals: Specification sheets, operation manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Information for testing, repair, troubleshooting, assembly, disassembly, and recommended maintenance intervals.

e. Replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

f. Performance, Test, and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturers' Warranty Registration papers as described herein.

h. Sufficient information, (detailed schematics of subsystems, assemblies, and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

i. Any other items defined herein.

4. Local Reference Diagrams: Within each equipment rack, enclosure, or cabinet, the Contractor shall place a functional diagram of the system(s) in a clear plastic sleeve secured to the equipment rack, cabinet, or enclosure.

5. Intellectual Property: Provide all required items and written release as described herein.

6. Training Program: Proposed training materials and program outline.

7. Spare Parts and Remote Controls: Contractor shall submit record of Owner sign-off of turnover of spare parts and remote controls.

1.19 PROJECT MANAGEMENT

A. Project Manager: Contractor shall appoint a Project Manager who will be the main point of contact for Owner and Consultant regarding the project.

B. Responsibility: Project Manager is responsible for the following:

1. Successfully completing the contract in a timely manner.
2. Overseeing work and performance of all employees and Subcontractors who have been hired by Contractor, and ensuring compliance with specification.
3. Completing and submitting required documentation.
4. Attending project coordination meetings as required by Owner, Consultant, and Contractor. Contractor is responsible for taking minutes of these meetings and distributing copies to all participants in a timely manner.
5. Coordinating with Owner, Consultant, Architect, General Contractor, and other Contractors involved in the project to ensure smooth flow of work and on-time project completion.
6. Providing a written weekly progress update to the Owner and Consultant in a PDF format emailed to the project team.
7. Reporting all unexpected conditions and problems that may result in delay or expense to Owner and Consultant immediately upon discovery.

C. Change of Project Manager: If Contractor seeks to change Project Manager during the course of the Project, such change is subject to prior written approval from Owner.

D. The Owner reserves the right to request a change of project manager at any time for any reason.

1.20 EXAMINATION OF EXISTING CONDITIONS

A. Examination: Contractor shall examine the facility and construction documents to the extent necessary to plan for efficient installation strategies prior to the delivery of materials to the site or the commencement of work. Other documents (Architectural Drawings, hardware schedules, etc.) may be made available upon request. Failure to adequately complete the examination shall not result in change order requests.

B. Acceptance of Conditions: Commencement of work by Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to Owner prior to commencement.

C. Observation: If Contractor observes—during preliminary examinations or subsequent work—existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, Contractor shall report these to Owner in a timely manner.

D. Pre-Existing Damage: If Contractor observes damage to finished surfaces before they begin installation in any area, Contractor shall document by taking digital photos of the damaged area(s) and immediately notify Construction Manager and Consultant via email with attached photos.

E. Damage during Installation: Any damage caused by, or reasonably believed by the Construction Manager to be caused by the Contractor shall result in back-charges for said damages. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

1.21 CONTRACT MODIFICATION PROCEDURES

A. Changes: Changes to the contract may be initiated by Owner, Consultant or Contractor.

B. Request for Information (RFI): If a change originates with Contractor, the Contractor shall submit an RFI for Consultant review. If it is deemed a change is necessary, the Consultant shall issue a PR to address the change.

C. Proposal Request (PR): If a change originates with Owner or Consultant, Consultant shall issue a Proposal Request to Contractor.

D. Change Proposal (CP): If a change originates with Contractor, or if Contractor receives a Proposal Request from Consultant, Contractor shall submit a Change Proposal to Consultant to review.

   1. References: A Change Proposal shall reference the work to be performed, and shall include the cost change to the Project (if any) and the time change to the scheduled completion (if any).

   2. Additional Information: Consultant may request additional information to be supplied with the Change Proposal for consideration.

   3. Acceptance: Owner reserves the right to accept or reject Change Proposals.

E. Change Order: A Change Order is a modification of the contract.

   1. If a Change Proposal is approved, Owner will issue a Change Order that references PR and/or CP. Change Order is not valid until it has been signed by Owner.

   2. Work performed or equipment supplied outside of contract without a valid Change Order is done at Contractor's own risk.

1.22 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Storage: Contractor shall provide secure material storage. If Contractor chooses to store cabling or equipment at project site, that Contractor shall receive written approval from GC or Owner to identify acceptable location. All equipment provided by the Contractor remains the responsibility of that Contractor until Owner has beneficial use of the equipment.

B. Protection: Contractor shall take all necessary precautions to protect materials from the following:

   1. Theft

   2. Vandalism/Tampering

   3. Dents

   4. Scratches

   5. Dust

   6. Temperature

   7. Weather

   8. Cutting

   9. Paint

10. Other hazardous conditions

C. Replacement: Contractor shall replace any damaged or lost material as required by Owner or Consultant.

D. Installed Materials: Installed materials remain the responsibility of the Contractor until Acceptance. Contractor shall take necessary precautions to ensure the safety and security of installed materials.

1.23 INTERFERENCE WITH THE FACILITY

A. Transportation and storage of materials at the facility, work involving the facility, and other matters affecting the habitual use by the Owner of the Owner's buildings, shall be conducted to minimize interference, and at times and in a manner acceptable to the Owner.

1.24 ON-SITE CONDUCT

A. Conduct: Any demonstration of rudeness, use of profanity, or lack of respect by Contractor Personnel to a building tenant will be cause for immediate removal from the premises, and such Personnel will not be allowed to return. Contractor and Contractor's Personnel are to remain in project area.

B. Vandalism: Graffiti or vandalism will not be tolerated. Any Contractor/Personnel caught in the act shall be immediately removed from the premises and will not be allowed to return.

C. Hazardous Conditions: No one shall be allowed to endanger the building, its premises, or its occupants in any manner whatsoever. In the event that a situation occurs which threatens the building or its occupants in any manner, Contractor, Contractor Personnel, Subcontractor, etc. shall take immediate steps to correct the hazardous condition. In the event that Contractor's Personnel fail to correct hazardous condition, Owner reserves the right to immediately take steps to correct the situation at Contractor's expense.

1.25 SAFEGUARDS AND PROTECTION

A. Barriers: Provide and maintain suitable barriers, guards, fences and signs where necessary to accommodate the safety of others relative to and/or for the protection of this work.

B. Regulations: Comply with OSHA, Federal, State, Local, and Owner regulations and standards pursuant to this work.

C. Protection: Protect all materials and equipment to prevent the entry or adhesion of any and all foreign material. If necessary, cover equipment with temporary protective material suitable for this purpose.

D. Finishing: Check, clean and remove defects, scratches, fingerprints and smudges if necessary from all equipment and devices immediately prior to Acceptance of the Installation.

E. Damage: Replace all damaged or defective material or work at no additional cost prior to Final Acceptance.

F. Documentation: Provide written description of accidents by workers, staff, and general public of any incident occurring on the project. Report incident in writing to Owner's representative immediately and to the Project Manager for follow up.

1.26 OWNER-FURNISHED PRODUCTS

A. Delivery: Owner is responsible for delivery of Owner-furnished products to the project site, unless otherwise specified in this document.

B. Placement: Contractor is responsible for locating, inspecting, and moving Owner-furnished products to their final installation position.

C. Inspection: Contractor shall report any damage, discrepancies in quantity, type, or function to Owner and Consultant immediately upon discovery.

D. Warranty: Contractor assumes no responsibility for any material warranty for Owner-furnished products. Contractor shall be responsible for integrating, cabling, and installing Owner-furnished products under the same warranty conditions as other products furnished by Contractor.

1.27 QUALITY ASSURANCE

A. Assurance: It is the intent of these specifications to describe and provide for a complete, professional, and reliable installation.

B. Qualifications: Contractor employees who are engaged in installation shall be adequately trained in the tasks they are expected to perform.

C. Acceptability: Owner shall determine the acceptability of work.

D. Regulatory Requirements: Contractor shall comply with code requirements that apply to the work being performed.

E. Certifications: Where manufacturer certifications are required for warranty or for authorized resale, installation personnel shall have received such certification prior to the start of installation of those manufacturers' materials.

1.28 QUALITY CONTROL

A. Installation: During installation period, when connections are made to the Owner's existing infrastructure, Contractor shall use care to ensure that such connections will not have a negative impact which could reduce or hamper existing systems.

1.29 OWNER'S RIGHT TO USE EQUIPMENT

A. The Owner reserves the right to use equipment, material and services provided as part of this work prior to Acceptance of the Work, without incurring additional charges and without commencement of the Warranty period.

1.30 INTELLECTUAL PROPERTY OWNERSHIP

A. All intellectual property shall remain in escrow for an unlimited period of time. All supporting documentation including but not limited to: software, firmware, programming, uncompiled source code, graphic files, diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner on a USB flash drive for all spaces and all systems. The integrator and/or programmer shall also maintain a current live copy incorporating all system modifications to be provided at the Owner's request and for system restoration upon a failure.

B. A written release shall be given by the Contractor and all other required parties for all programming and configuration done by the Contractor and/or Subcontractors. This release will acknowledge the Owner's ownership and right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner’s choosing.

PART 2 - PRODUCTS

2.01 BASIC EQUIPMENT AND MATERIALS REQUIREMENTS

A. Standards: Equipment and materials used to accomplish the goals of this project shall meet standards for good engineering practice as defined within this document.

B. Quality: Products specified in these documents are intended to establish a baseline or operational, functional, and performance-based standards that all proposed products shall meet or exceed by functionality and quality.

2.02 FACTORY-ASSEMBLED PRODUCTS

A. Manufacturer: Reference to specific equipment manufacturers does not imply that all products produced by that manufacturer meet the specification requirements.

B. Age of Equipment: Equipment shall be new and unused with full manufacturer’s warranties. Contractor shall supplement such warranties as required by the specification. Contractor shall immediately notify Consultant of any product that will be or is expected to be discontinued by the end of the project for resolution.

C. No Modification: Where a product is available from a factory/manufacturer to meet the needs as outlined, that product shall be used without modification to ensure the full factory warranty is maintained.

D. Like Materials: Like materials used shall be of the same manufacturer, model, and quality unless otherwise specified.

E. Software/Firmware: No software or firmware is to be used unless specifically authorized by Owner or its appointed representative.

2.03 RACKS, CABINETS, HARDWARE

A. Equipment Racks and Cabinets: Provide racks and cabinets as specified herein and/or described in accompanying documents, appendices, or drawings. Verify that any existing racks and/or cabinets provided by others are complete, bringing any discrepancies to the attention of Owner and Consultant prior to beginning the installation.

B. Shelves and Mounts: Contractor shall supply necessary mounting hardware to install rack-mounted equipment. Mounting hardware shall be a product of the manufacturer of the equipment to be mounted, or manufacturer of the rack system, or approved by either for use with their product. Provide supporting channels, shelves, rack mounts, and/or rack ears as recommended by equipment manufacturers.

C. Screws and Washers: Contractor shall provide screw head types appropriate to the level of security required for the equipment and racking. Screws shall include polyethylene or nylon washer.

1. Public Access Areas: Star post or square post security screws shall be used for hardware and equipment mounted in equipment racks and consoles in areas that are accessible to the public.

2. Restricted Access Areas: Philips head screws may be used where a secure room entrance or locked rack/console door prevents public access.

2.04 POWER DEVICES

A. Power Strips: Unless otherwise specified, power strips shall be UL listed and rated for 20 amp continuous electronic loads. Outlets shall be 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Cords shall be 12/3 SJT with molded plug.

B. Power Distribution Panels: Unless otherwise specified, power distribution panels shall be UL listed, rack mounted, rated for 20 amp continuous electronic loads, with switch and pilot light. Up to eight outlets shall be mounted to the back, each rated 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Switch and pilot shall be mounted to the front. Cords shall be 12/3 SJT with molded plug.

C. Contractor shall provide acceptable power distribution units as required in order to provide sufficient outlet connectivity for Contractor-furnished and Owner-furnished equipment indicated on drawings and equipment schedules, plus up to 20% additional capacity for future growth. This may be in addition to any power distribution equipment indicated on equipment schedules.

2.05 CABLE AND CONNECTORS

A. Cable: Cable shall be selected and applied in a manner defined by signal type, consistent with best industry practices. Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Where required by the NEC, substitutions of air handing plenum cable shall exactly match the normally applied product and shall meet the standards of UL Standard #900 and the NEC Articles 800 and 820.

B. Connectors: Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Strain reliefs and cable clamps shall be sized for the connector and the cable.

C. Color: Cable and connector color shall be coordinated with Consultant to maintain consistency with cable and connector color schemes used by other trades.

2.06 CABLE MANAGEMENT

A. Plastic Cable Ties: Single use white nylon plastic cable ties, appropriate screw fittings, or mounting clips may be used for AC power cable management within racks and enclosures. Plastic/nylon cable ties shall not be used for signal and DC cables.

B. Velcro Cable Ties: Velcro straps shall be used for all signal and DC cables. Velcro straps shall be black, with no logo or decoration, except as authorized by Consultant.

2.07 ANCILLARY HARDWARE

A. General: Contractor shall provide ancillary and required accessory items necessary to provide a complete and fully functional system to Owner.

B. Interpretation: Exclusion of or limitation in the language used in the drawings or specifications shall not be interpreted as meaning that ancillary or accessory items of work or equipment necessary to complete or make the installed system fully functional can be omitted.

2.08 GROUNDING HARDWARE

A. Refer to Section 27 05 26 for specific Grounding and Bonding requirements.

B. Provide data/telecommunication grounding systems indicated in the project drawings and specifications. Products shall include, but are not limited to, cables/wires, connectors, terminals, compression lugs, grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, ANSI/TIA and established industry standards for applications indicated.

2.09 COMPATIBILITY OF RELATED EQUIPMENT

A. Existing Equipment: Equipment and systems specified in these documents shall be assumed to be compatible with the systems already installed at Owner site(s) and as identified in this document as related to this project.

B. Installed Equipment: Specified equipment and systems shall be compatible with all other equipment and systems as offered by Contractor, thus placing the responsibility on Contractor to ensure proper interaction.

2.10 LICENSES

A. Any and all licenses required for system functionality shall be provided.

2.11 MAINTENANCE MANUALS

A. Contractor shall produce a maintenance manual showing interconnection of equipment and any special procedures necessary for proper operation and maintenance of the systems.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor shall provide, furnish, deliver, transport, erect, install, connect and configure all of the material and equipment described herein or depicted on any bid package document or drawing, as required for a turnkey solution.

3.02 COORDINATION

A. General: Contractor shall cooperate with other Contractors for proper provisioning, anchorage, placement, and execution of all work. Interference between the work of various Contractors shall be resolved before installation. In the event of conflict on space requirements or location of devices, refer the matter to Owner and Consultant for decision.

B. Related Work: References to the following related work do not limit or release Contractor from the responsibility of coordination with other trades or from having the necessary knowledge of other non-referenced work.

1. Work by General Contractor.

2. Work by other Technology Contractors.

3. Work by Electrical Contractor, including electrical rough-ins and surface-mounted raceway.

C. Delays: Contractor shall coordinate with all other trades to avoid causing delays in the installation schedule.

D. AC Power: Contractor shall coordinate with General Contractor its requirements for proper AC power to service all equipment installed by Contractor.

E. Low Voltage Sleeving: Contractor shall provide openings through walls as necessary, with sleeving and fire-stopping materials installed in a professional manner to meet local and national codes.

F. Grounding and Bonding: Contractor shall coordinate with General Contractor its requirements for proper grounding and bonding to their equipment.

G. Surface-Mounted Raceway Coordination

1. General and Electrical Contractors: Contractor shall coordinate with General Contractor and Electrical Contractor the installation of surface-mounted-raceway where not provided but made necessary by non-penetrable wall.

2. Verification: Contractor shall field verify and coordinate the proposed use of surface-mounted raceway at any location with Consultant and Owner.

3.03 BASIC EXECUTION REQUIREMENTS

A. General: Contractor is responsible for following industry standards of good practice for telecommunications and networking equipment.

B. Aesthetic Factors: With the installation of equipment and cables, consideration shall be given not only to operational efficiency but also to overall aesthetic factors. Contractor shall redo, at no cost to Owner, any work deemed by Owner to appear sloppy, hastily done, or unprofessional. Owner shall make final decision over whether work shall be redone.

C. Manufacturers' Recommendations: Manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers or as indicated in their published literature unless otherwise noted herein.

D. Protection of Work Area: Work shall be properly protected during construction; including shielding soft or fragile materials, protecting against dust and dirt, protecting and supporting cable ends off of the floor and from other traffic, protecting floor box lids, and temporarily plugging open conduits during construction. Upon completion, installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of work shall be removed from the premises.

E. Protection of Cable and Equipment: Contractor shall make appropriate preparations to protect all cabling and equipment from foreign material. Foreign material is defined as any substance or material that would void the manufacturer's performance warranty, impact ratings (UL, Plenum, etc.), or cover up markings needed for inspection. Foreign material includes, but is not limited to, paint overspray (intentional or not), fire-stopping material, drywall compound, or any other chemical, liquid, or compound that could come in contact with cables, cable jackets, cable termination points, or other equipment.

1. Cleaning of cables or equipment with harsh chemicals from a failure to comply with Protection of Cable and Equipment clause is unacceptable. Contractor shall replace any affected cable, cable components, or equipment in their entirety at Contractor's sole cost.

F. Waste Materials: Contractor shall keep work area neat, orderly, and free from accumulation of waste materials. Remove trash and debris from the building and job site as required to maintain a clean work environment at all times. Rubbish shall be moved to a common trash point or receptacle on the job site as determined and directed by General Contractor or Owner.

G. Dumpsters: No construction debris shall be placed in building's dumpsters. Contractor shall provide a dumpster for construction waste and debris at own expense. Said dumpster shall be emptied on a regular schedule. Location of dumpster shall be arranged through Building Management. Appropriate measures shall be taken to protect asphalt or other ground surfaces.

H. Ceiling Grid: Contractor shall not hang cable supports from ceiling grid wire.

I. Roof Deck: Contractor shall not shoot into the roof deck for mounting cable hangers.

J. Mounting: Equipment and enclosures shall be mounted plumb and square in relation to the structure.

K. Raised Floor: All cabling installed below the raised floor shall be placed in the provided cable trays with appropriate means to hold cable in place. If no cable tray exists, Contractor shall provide J-hooks to hold cables in place. Sleeves shall be utilized for cable egress.

L. Motorized Furniture: Care shall be taken to properly dress all cables placed within motorized furniture and provide sufficient cable length and strain relief to allow motorized elements to operate within their full range of travel.

M. Flexible Furniture: Care shall be taken to properly dress all cables placed within flexible or re-configurable furniture to provide sufficient cable length and strain relief to allow full range of travel for flexible furniture configurations.

3.04 PREPARATION

A. Existing Equipment: Prior to any installation, the Contractor shall prepare the site by removing any remaining debris, leveling equipment racks (where appropriate), and verifying information and systems stated to be in-place are ready for use.

B. Equipment for Installation: Prior to installation, Contractor shall ensure that required major equipment has been secured and is ready for installation.

3.05 CLEANING

A. Tool Clean-up: Contractor is not permitted to use restrooms for tool clean-up. A slop-sink may be provided in janitorial closet on each floor for cleaning of tools and equipment and as a source of water. Janitorial closet or maintenance area or shop shall be kept clean at all times. Contractor or Contractor's Personnel found using restrooms for clean-up or other similar purposes shall be subject to removal from building.

B. Daily: At the end of each work period or day, Contractor shall remove excess packing, drilling remnants, and other non-equipment related parts, materials, or debris to ensure a clean, safe, and professional working environment.

C. Carpet: Contractor shall ensure that no damage to carpeting occurs as a result of their work. Contractor shall cover carpets in areas of work to prevent wire and other debris from entering the carpet.

3.06 DEMOLITION

A. General: The Contractor shall be responsible for removal, collection, transportation, and recycling of all cabling and components that become abandoned as a result of this project. This shall include the delivery of cable and components to the proper recycling centers. If material is to remain on site for more than seven days after removal, Contractor shall coordinate with Owner for an acceptable storage location.

B. Verification: Contractor shall field-verify existing conditions prior to beginning demolition work. Any discrepancies shall be reported to the Consultant prior to the start of work in order to prevent disturbance of existing installation(s). Beginning work shall indicate acceptance of existing conditions. Contractor is responsible for immediately restoring any outages caused as a result of removing or damaging adjacent cabling, systems, or services.

C. Abandoned Cable: The Contractor shall remove all abandoned cable back to the headend. Where it is not possible to remove cables without damaging other cables that are to remain, such as in a shared conduit, the Contractor shall report these conditions to the Consultant for approval. These cables shall be cut at entry and exit points, leaving a minimum of 24” of cable at each end.

D. Cover Plates: The Contractor shall provide and install blank cover plates for any outlets or junction boxes that are to be left in place and from which all cables have been removed. Cover plates shall match the Project standard color and finish.

E. Equipment: The Contractor shall remove all equipment abandoned as part of this project. The Contractor shall be responsible for the delivery of this equipment to a proper recycling facility. Any electrical service connected to the equipment shall be properly decommissioned and labeled to prevent any safety issues.

F. Right of Refusal: The Owner shall have first right of refusal to any abandoned cable or equipment. The Owner has the right to remove any components from the equipment before it is recycled.

3.07 FIRE STOPPING

A. Contractor is responsible for applying fire-stopping material in and around all openings that it creates or are created for it, whether or not specifically indicated in specifications or project drawings, where code requires the use of fire stopping material.

B. Contractor shall ensure that all fire-stopping materials meet appropriate codes and are installed in a neat and workman like manner.

3.08 WATERPROOFING

A. Contractor is responsible for creating a waterproof seal in and around any openings to the outside environment that are created by Contractor or for systems being installed.

B. Contractor shall ensure that all waterproof materials meet appropriate codes and are applied according to good engineering practice.

3.09 RACKS, CABINETS, AND HARDWARE

A. Racks and Cabinets: Contractor shall assemble and install racks and cabinets.

B. Installation Hardware: Install hardware in a secure manner. Screws shall be tightened to a torque just sufficient to secure equipment without deforming washers beyond their original diameter.

C. Considerations: Rack mount equipment shall be secured as recommended by the manufacturer with consideration to airflow, power, and in/out connections.

D. Cross Connections: Where cross connections are required between equipment, interconnections shall be installed using cable management devices to secure cables in a neat and workmanlike manner, applying best industry practices.

3.10 INSTALLATION REQUIREMENTS

A. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

B. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a "break-away", or other approved method.

C. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of pathway entry and exit.

D. All cable shall be free of tension at both ends.

E. PLENUM rated cable shall be used in areas used for air handling or where required by code.

F. Contractor shall replace any cables that have been damaged or abraded during installation.

G. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used and will not harden or become adhesive with age.

H. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit or surface mount raceway.

3.11 CABLE

A. Cable treatment: Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the rating of the manufacturer.

B. Splicing

1. Voice, data, and other twisted pair cables: No splices shall be installed in any voice, data or twisted pair cables.

2. Technology systems: No splices shall be installed in any cable less than five hundred (500) feet in length.

3. Digital multimedia/video cables: No splices are allowed in any digital multimedia/video cable.

4. Overhead paging systems: Cable splices for constant voltage overhead paging system shall occur only at speaker, amplifier or volume control knob locations.

C. Lengths

1. Variations: Where cables are to be of the same length, variations in the length shall be less than plus or minus ½ inch. Lengths of cables are based on the length of the unterminated signal conductors.

2. Labeling: Cables, regardless of length, shall be marked with a labeling scheme approved by Consultant.

3. Service Loops: A surplus of cable, located at or near the point of termination to facilitate potential future changes, shall be provided where appropriate. Cables shall have a minimum cable slack of 10ft (3m) at the telecommunication room(s) and 3.28ft (1m) at each telecommunications outlet in the suspended ceiling unless noted otherwise. Service loops shall be stored in an extended loop or in a figure-eight configuration, not in bundled loops.

D. Grouping

1. Cables shall be separated into like groups according to signal or power levels.

2. Power Cable Group: Power cables shall be secured to one side of the rack separate from any low-energy signal cable groups. Separation shall be a minimum of 4” in all directions.

3. Signal Cable Group: Signal cables shall be grouped according to signal type and secured to one side of the rack separate from any power cable groups. Separation shall be a minimum of 4” in all directions.

E. In Equipment Racks

1. Equipment rack wiring and cabling shall be neatly dressed.

2. Fastening: Rack cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame.

F. Support for Cables Outside of Equipment Racks

1. External wire and cables shall be supported at least every 5 feet (1.5m) from the structure and as required to maintain less than 12 inches of cable sag between supports without over-tensioning the cables. Contractor shall vary the precise distance between cable supports on long runs to avoid harmonics issues.

2. Hardware: Cables shall be supported by J-hooks, cable tray, or ladder rack. Hardware shall be secured to building structure using 3/8” threaded rod supports.

a. Right Angles: Cables are to run at right angles to the structure, placed above ceiling in halls or corridors.

b. Height: Cables shall not run above red iron joist.

G. Concealment: Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests. Cabling systems installed in public areas shall be installed within walls, ceiling, or floors or within surface wiring pathways, as dictated by codes and good engineering practice.

H. Velcro Straps for Horizontal Cabling: Straps shall be installed snugly without deforming cable insulation. Straps shall be spaced at uneven intervals not to exceed 4 feet.

I. Cable Ties and Velcro Straps within Equipment Racks and Cabinets: Ties and straps shall be installed snugly, without deforming cable insulation, at uneven intervals not to exceed 8 inches. Cable ties shall only be used for non-signal carrying cables. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Obstruction: Contractor shall notify Owner immediately if any obstruction or hazard is discovered in a pathway provided by others.

3.12 CONNECTORS

A. Preparation: Cables shall be carefully prepared and connectors installed as directed by the manufacturer. Proper stripping devices and crimping tools shall be used.

B. Terminations: Connectors shall be carefully fitted to mating devices on equipment to avoid damage to mating contacts, inserts, or bodies. Specialized terminations shall be made in a neat and secure manner suited to the service of the wire and as directed by the manufacturer. Contractor shall use manufacturer specified terminations when those specifications exist.

C. Soldering: A person skilled in that practice shall execute soldered terminations. Any excessive insulation displacement resulting from soldering shall be grounds to require the Contractor to re-terminate the connector.

D. Adapters: Adapters shall be used only where the identity of the necessary type of connector is unknown at the time of installation, such as for Owner-provided equipment or in anticipation of future equipment upgrades, with Consultant’s approval.

3.13 SPARE PARTS AND REMOTE CONTROLS

A. Keys: Contractor shall turnover all keys, tagged and organized by type on individual key rings, to Owner upon project completion.

B. Refer to individual sections for spare parts and remote control requirements.

3.14 EQUIPMENT INSTALLATION

A. General: Contractor shall make system properly operational and physically secure by mounting equipment and related accessories into furniture, consoles, and racks as required. Manufacturer’s guidelines for installation shall be followed. Discrepancies in installation procedure or inability to complete a given task due to a shortage of materials or malfunctioning equipment shall be reported to Consultant immediately upon discovery.

B. Equipment Placement: Contractor shall locate equipment as indicated on drawings and as specified herein. Where such information is not provided, Contractor shall follow industry best practices and locate operable devices at convenient positions; heat generating devices at the top and seldom-accessed equipment below.

1. Unless otherwise specified, end user-operable devices shall be positioned within the range of front wheelchair access per ADA standards.

C. Equipment Installation: Equipment shall be installed as directed by the manufacturer using equipment manufacturer's desktop mounting frames, equipment tubs, installation hardware, and techniques. Contractor shall be responsible for moving equipment from storage and for providing necessary personnel or devices to carry and lift equipment around obstacles and into operating position.

3.15 SOFTWARE AND FIRMWARE

A. At the completion of the project the Owner shall have the option to receive final software updates and firmware updates to the latest versions before the project is paid in full at no cost to the Owner.

3.16 ROUGH-IN

A. Scheduling: Contractor shall make every effort to install systems per this specification in a timely manner including rough-in of cabling and other apparatus where appropriate to stay on schedule.

B. Protection of Environment: Where cabling and/or equipment is installed prior to other trades completing their work in an area, Contractor shall take necessary precautions to cover, wrap, or otherwise protect to reduce possible damage which may result from plastering, painting, cleaning, or other such work completed after installation and before substantial completion of the project.

3.17 CUTTING, DRILLING, PATCHING, AND PAINTING

A. Coordination: Contractor is responsible for coordinating with the General Contractor and other trades when any cutting or drilling is required for the installation or proper performance of the specified systems.

B. Restoration: Contractor is responsible for returning all surfaces (including walls, floors, and ceilings) to their previous condition after any cutting including painting.

C. Painting: Contractor is responsible to paint all new work including exposed pathway to match the conditions.

3.18 LABELING

A. General: Rack-mounted equipment and hardware shall be labeled as required herein. Connectors, jacks, receptacles, outlets, cables, cable terminations, terminal blocks, rack mounted equipment, active slots of card frame systems, etc. shall be clearly, logically, and permanently labeled in a manner acceptable to Consultant.

B. Approval: Proposed wording and/or numbering schemes for labeling shall be provided to Consultant for review and written approval prior to procurement or installation.

C. Labels used shall be permanent and secure. Provide labeling as follows unless otherwise noted in a specific section:

1. Like Size: All labels, including engraved labels, shall be sized to match other labels used for same purpose.

2. Equipment Racks: For enclosed racks containing equipment, provide labels on each equipment rack rear door or console rear panel reading “No user serviceable parts. Refer service to qualified technician.”

3. Installer and Consultant Identification: Position at the front top center section of each equipment rack a label that states the names of system Installer and Consultant.

4. Custom Panels: Custom panel nomenclature shall be engraved, etched, or screened. Markings are to be designed to ensure consistency and clarity within and without of system. Verify markings and placements by submitting label sample layouts to Consultant for approval prior to procurement.

5. Documentation: Labeling information shall appear on the as-built drawings.

3.19 FIRE-STOPPING

A. If Contractor removes anything from an opening in a fire-rated wall, Contractor shall restore the fire-rating condition of the wall to the same condition as before Contractor started its work. Depending on the size of the opening, this may involve sheetrock patching, in addition to use of other appropriate fire-stopping materials

3.20 ADDITIONAL ENGINEERING SERVICES

A. General: Contractor is responsible for securing necessary engineering services were needed to meet the needs of the installation.

B. Change Orders: Only when Contractor can show that additional engineering services are needed as a result of changes to the scope of the services being requested in the contract documents will Owner entertain a Change Order Request for these services.

3.21 TESTING

A. Procedure: Contractor shall develop a rigorous testing procedure to ensure full functionality and durability of installed systems under heavy-use conditions.

B. Supplies: Contractor shall supply testing equipment needed to verify compliance with specifications found in these documents.

C. Schedule: Contractor shall complete required testing prior to the substantial completion inspection by Owner and Consultant.

D. Data: Test data shall be properly documented and recorded so that it is available for final inspection.

E. Quality Control: Testing may be repeated during the inspection process at the request of Owner or Consultant.

F. Prior to energizing or testing the system, Contractor shall ensure the following:

1. Installation: Products are installed in a proper and safe manner per the manufacturer’s instructions.

2. Cleanliness: Products are neat, clean, and unmarred, and parts securely attached. Dust, debris, solder, splatter, etc., is removed.

3. Cables and Connections: Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. Grounding: Electronic devices are properly grounded.

5. AC Power: Each AC power receptacle is tested with a circuit checker for proper hot, neutral, and ground connections prior to connecting equipment.

3.22 GROUNDING

A. Refer to Section 27 05 26 for specific Grounding and Bonding installation requirements.

3.23 TRAINING PROGRAM

A. Contractor shall provide training in the manner delineated below in addition to specific requirements identified in subsequent sections.

B. Contractor shall provide audio-video recording of each training session to Owner.

C. Prior to scheduling or delivering End User training, Contractor shall confirm that:

1. Closeout submittals have been accepted by Owner and Consultant.

2. Final closeout inspection has been completed and punch list items rectified.

3. Training schedule dates have been coordinated with and approved by Owner and Consultant.

D. Training shall include:

1. Approved handouts.

2. Practical and comprehensive operation of systems.

3. Basic system troubleshooting techniques.

4. Basic system maintenance.

E. Training Blocks

1. Training time is defined as those hours specifically set aside for the sole purpose of training end users. Credited time will not be given for any time spent providing instructions to the Owner's staff for a system not completed or that has not passed final acceptance by the Owner and Consultant, or training performed outside of the approved training program.

2. This training will be divided into training session "Blocks" as coordinated with the Owner.

a. The first training session block shall consist of training intended for the common system operators. Such training, at a minimum, shall include the day to day use of the system.

b. The second training session block shall consist of training administrators of the day to day administration of the system. Such training, at a minimum, shall include use

of the administration control functions of the systems, user setup, and filtering and pulling reports.

c. The third training session block shall consist of training administrators on system troubleshooting, maintenance, and updates. Such training, at a minimum, shall include using the system tools to diagnose issues, diagnosing common physical equipment issues, performing simple maintenance, and performing system updates.

d. The fourth training session block shall consist of a training session structured for high-level users, for example staff trainers who will provide instruction to other users and will include advance system configuration and operational knowledge needed to maintain and manage all specified technology systems. The Contractor may elect to engage the Manufacturer(s) in certifying the high-level end users in the systems at no cost to the Owner.

F. The Contractor shall issue a certificate of training completion to the trainees upon completion of their training. Such certificates must be signed by both the trainer and trainee(s) for the Contractor to receive training credit.

3.24 WARRANTY AND MAINTENANCE PROGRAM

A. Contractor shall provide a warranty conforming to the stipulations below in addition to specific requirements identified in subsequent sections.

B. As part of the base proposal cost, the Contractor shall include a 1-year turnkey warranty period with full support costs.

C. The Warranty period shall begin after all punch list items have been rectified. The Contractor shall receive a letter of completion from the Consultant and Owner indicating project completion and starting the warranty period.

D. The warranty and support work included in this contract shall cover the following materials, software, and services, without additional cost to the Owner:

1. Inspections, preventative maintenance, and testing of equipment and components. The Contractor shall schedule a 10-month on-site preventative system review 10-months into each year of warranty and support including system inspections, preventive maintenance, software upgrades/patches, and testing of equipment and components.

2. Regular Service, Emergency Service, and Normal Service.

3. Labor, travel, equipment, materials, and transportation cost for all services covered by this warranty.

E. Response Time: Contractor shall respond to calls for warranty services in a timely manner as delineated below.

1. The Owner reserves the right to make the final determination of emergency or normal service calls and the right to coordinate the best times for service of any system failure.

2. Emergency service calls are defined as failures which prohibit the use of a typical system function(s) and pose a life safety concern, or such failures which cause a major impact to the Owner’s daily operations.

a. The Contractor shall provide remote service diagnosing the impact within two (2) hours after notification by the Owner.

b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within four (4) hours after notification by the Owner.

3. Normal service calls are defined as failures which prohibit the use of typical system function(s) but which do not inhibit critical system usage, do not pose life safety concerns, and do not create a major impact to Owner's daily operations.

a. The Contractor shall provide remote service correcting the impact within twenty-four (24) hours after notification by the Owner.

b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within forty-eight (48) hours after notification by the Owner.

4. The Contractor shall supply Service Request forms and or proper contact procedure to the Owner with instructions for proper notification of the Contractor for warranty service. By following said instructions, the Owner shall constitute proper notification for any needed warranty service

F. Repair Time: Contractor shall locally stock critical parts in sufficient quantities such that emergency repair or replacement shall be guaranteed within twelve (12) hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality and provided permanent replacement is achieved within ninety-six (96) hours. Contractor may contact the Owner for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.

G. Transmittal: A copy of this Warranty shall be delivered to and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.

H. Registration: Contractor shall register Warranty papers for all equipment and software in the name of the Owner and furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.

I. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.

1. Service/Warranty Procedures: Contractor shall submit a warranty service plan containing all contact information and Owner service call directions for Owner review with project close-out submittals.

J. Resolution of Conflicts:

1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory and stating specific areas of dissatisfaction in writing.

2. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within ninety-six (96) hours, the Owner may appoint an alternative service agency or person to fulfill the terms of the Warranty at the expense of the Contractor. This action may be taken repeatedly until the Owner is satisfied that

Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

End of Section

SECTION 27 0500 – COMMUNICATIONS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements related to furnishing and installing Category 6/6a Cabling and Termination Components and related subsystems as part of a Structured Cabling System.

C. Backbone system comprising fiber optic cabling and horizontal (station) cabling is covered under this document.

D. Others will provide the network electronics for the LAN within the Telecom Rooms (TRs) and will be responsible for connecting the new cabling infrastructure to the LAN. The Contractor, however, shall supply the patch cords. The Contractor shall be available on site during the crossover to assist with any cabling issues that may occur during the connection.

E. The Electrical Contractor shall install conduits and surface raceway for new technology outlet locations unless otherwise noted.

F. The Telecommunication Contractor shall provide and install all sleeves through the wall penetrations as required whether or not specifically marked on Project Drawings, unless otherwise noted.

G. All cables and related terminations support, and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in the following section(s).

H. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Electrical Code in the state where the work is to be performed, and present manufacturing standards.

I. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 26 – Grounding and Bonding for Technology Systems

C. Section 27 05 28 – Pathways for Technology Systems

D. Section 27 05 37 – Firestopping for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 13 00 – Communications Backbone Cabling

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 40 00 – AV/Multimedia General Requirements

I. Section 27 41 00 – Audio Visual Systems

J. Section 27 51 00 – Distributed Communications Systems

K. Section 27 60 00 – Physical Security General Requirements

L. Section 27 62 00 – Electronic Access Control System

M. Section 27 64 00 – Video Surveillance System

N. Section 27 66 00 – Intrusion Detection System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

B. All references relate to the current version adopted by the city/county according to the authority having jurisdiction (AHJ). If the city/county has not adopted a version the latest version shall be utilized.

C. ASTM B633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel

D. ASTM A653: Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

E. ASTM A123: Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel

F. ASTM A510: Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

G. ANSI/TIA 569-E: Telecommunications Pathways and Spaces

H. ANSI/TIA 568.0-E, ANSI/TIA 568.1-E, ANSI/TIA 568.1-E, ANSI/TIA 568.2-D, ANSI/TIA 568.3-D, ANSI/TIA 568.4-D: Commercial Building Telecommunications Standard

I. ANSI/TIA-598-C-2005 – Optical Fiber Cable Color Coding

J. ANSI/TIA 606-C: Administration Standard for Telecommunications Infrastructure

K. ANSI/TIA 942-B: Telecommunications Infrastructure Standard for Data Centers

L. ANSI/TIA 607-D: Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises

M. IEEE: National Electrical Safety Code® (NESC®)
standards.ieee.org/about/nesc

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

B. Premises Distribution System: Written certification that the premises distribution system complies with the ANSI/TIA 568.0-E, ANSI/TIA 568.1-E, ANSI/TIA 568.1-E, ANSI/TIA 568.2-D, ANSI/TIA 568.3-D, ANSI/TIA 568.4-D, EIA ANSI/TIA/EIA-569-E, and ANSI/TIA/EIA-606-C.

C. Materials and Equipment: Where materials or equipment are specified to conform, be constructed, or be tested to meet specific requirements, Contractor shall supply, upon request by Consultant or Owner, certification that the items provided conforms to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

D. Certifications

1. The Contractor shall have an RCDD (Registered Communication Distribution Designer) on staff assigned to manage this Project; documented proof shall accompany the proposal response.

2. All installing personnel shall have completed and be certified in manufacturer training or BICSI (Building Industry Consulting Service International) installation training for UTP infrastructure systems, or the Contractor shall contract with manufacturer for installation of all proposed components. Company Certifications shall accompany the proposal response.

3. The Contractor's technicians shall be certified and trained in the connectivity hardware which is being installed.

4. The Contractor shall submit certification that installers are factory certified to install and test the provided products. No less than half of the crew to be used for the telecommunications installation shall be trained by that manufacturer for the work.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. The following items shall be provided in a single, combined, comprehensive submittal package for all Communications work, including sections 27 05 26 Grounding and Bonding for Technology Systems, 27 11 00 Communications Equipment Rooms, 27 13 00 Communications Backbone Cabling, and 27 15 00 Communications Horizontal Cabling. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Qualifications

1. Provide certificates for employees working on this project that show they meet the necessary qualifications described in the section above, including RCDD and manufacturer/connectivity-specific training, as well as any other certifications necessary to purchase and install the specified products.

C. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

D. Color Selection List

1. Provide a list of all communications equipment that will be visible to staff and visitors. Include a simplified description of the equipment that a non-technical person (i.e. Architect) can understand. Examples of such items include but are not limited to wall plates, data jack inserts, decora style devices, and decora cover plates.

2. For each item on the list, include all available color/finish options, with a checkbox next to each option for the Architect or Owner to select.

3. The Communications Contractor must receive confirmation of color selection from the Architect or Owner in writing before ordering any materials that will be visible after installation. If the Contractor fails to complete this step, the Owner reserves the right to object to an installed device's color and require that the Contractor replace it at no cost to the Owner.

E. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

F. Shop Drawings in addition to requirements in Section 27 00 00:

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

a. Floor Plans: Include device/equipment locations, cable routes, MDF/MER and IDF/TR zoning maps, maximum cable distance calculations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

b. Equipment rack elevation details

c. Elevations of telecommunication room walls with planned mounted equipment

d. Outlet faceplate details for all outlet configurations, sizes, and cable types

e. Overhead telecommunication room enlargements, providing dimensions of room and clearance for maintenance and operation

f. A labeling plan must be submitted to and approved by the Owner prior to installation, and the completed labeling must meet the approval of the Owner. EIA/TIA-606 standards are to be met.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Final Patch Cord Schedule

1. Provide a final schedule of proposed patch cords for Owner review. The list shall include columns for each of the following: Intended use (location & device type), length, color, cable rating (plenum, indoor/outdoor, etc.), shielded or unshielded, and quantity.

2. Patch cords listed in the pre-construction submittal shall be considered placeholders only. Review of the pre-construction submittal does not indicate approval of the patch cords and does not exempt the Contractor from providing this later patch cord schedule for final review.

B. Communications Labeling Scheme

1. Provide an example of each type of cable or equipment label for Owner review. Examples include standard data outlets, decora data outlets, surface mount interface boxes, horizontal cable runs, Category 6/6a patch panels, voice patch panels, fiber patch panels, data racks, and grounding busbars.

C. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for requirements.

1. Data cable test results

2. USB flash drive containing:

a. As-built drawings (CAD format)

b. As-built drawings (PDF format)

c. Detailed test results in original tester format (e.g. Fluke Linkware)

d. Detailed cable test results in PDF format

3. Warranty certification from connectivity manufacturer

1.09 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall be responsible for all materials until completion of Project.

B. Cable shall be stored according to manufacturer's recommendations at minimum. In addition, cable shall be stored in a location protected from vandalism and weather.

C. If cable is stored outside, it shall be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees Fahrenheit, the cable shall be moved to a heated (minimum 50 degrees Fahrenheit) location. If necessary, cable shall be stored off site at the Contractor's expense.

D. If the Contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

E. Commercial off-the-shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 LABELS

A. All labels shall be permanent and be machine generated (e.g., Brady or Panduit). No handwritten or non-permanent labels shall be allowed. Labels shall be Brady “I.D. Pro” or XC-Plus or equivalent. Labeling on backboards and/or equipment racks may be pre-cut adhesive type.

B. Characters on all labels shall be black printed on a white background.

C. Label size shall be appropriate to the cable size(s), outlet faceplate layout, patch panel design, or other related equipment sizes and layouts.

D. All labels to be used on cables shall be self-laminating, white/transparent vinyl, and be wrapped around the cable sheath. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.

2.03 LABELS FOR BACKBONE CABLING

A. Labels used to identify fiber optic cable or innerduct carrying fiber optic cable shall be labeled with a durable yellow polyethylene tag that reads “CAUTION Fiber Optic Cable” and includes blank spaces for adding (1) fiber count and (2) destination information.

B. Labels must be rigid vinyl, self-laminating, slotted for fastening with nylon ties and intended for long-term outdoor use.

C. Manufacturers:

1. XpressTags TG-2109
2. Panduit PST-FOBLNK
3. VIP Products’ “Caution Write-On Coverall Tag”
4. Or approved equal

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.02 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.03 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

B. The Contractor shall provide to the Owner a manufacturer's 15-year minimum warranty certificate for all materials, equipment, etc. Upon successful completion of the installation and subsequent inspection, the Owner shall receive the numbered certificate from the manufacturing connectivity hardware (patch panels, jacks, patch cords, 110 blocks, etc.) company registering the installation. This warranty shall include all labor, materials, and travel time.

C. The warranty shall ensure against product defects and guarantee that all approved cabling components exceed the specifications of TIA/EIA-568 and ISO/IEC IS 11801 for cabling links/channels, and that the installation will exceed the loss and bandwidth requirements of TIA/EIA 568 ISO/IEC IS 11801 for fiber links/channels for a fifteen (15) year period. The warranty shall apply to all passive structured cabling system components.

D. The warranty shall cover the failure of the wiring system to support the application that it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the TIA/EIA 568 or ISO/IEC IS 11801 component and link/channel specifications for cabling. Such warranty shall apply for a minimum of a fifteen (15) year period.

E. The warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective products(s), labeling of the new components, and testing of the circuit(s) at no cost to the Owner.

3.04 EXAMINATION

A. Verification of Conditions: Contractor shall examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and timely completion.

B. Contractor shall verify that cable lengths comply with published standards.

C. Contractor shall notify Owner of any proposed installation which is expected to exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner regarding alternative routing or location of cable.

E. Contractor shall not proceed until unsatisfactory conditions have been corrected.

3.05 SPARE PARTS

A. Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.

B. Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

3.06 INSTALLATION REQUIREMENTS

A. Refer to Section 27 00 00 for additional requirements.

3.07 COOPERATION

A. The Contractor shall cooperate with other trades and General Contractor's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided

such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.08 LABELING

A. General

1. The Contractor shall match the Owner's standard labeling scheme.

2. Clean surfaces before attaching labels.

3. Install all labels firmly and permanently. Labels attached to terminating equipment such as backboards, faceplates, 110 blocks, and patch panels shall be installed plumb and neatly on all equipment.

B. Labeling of Cabling and Termination Components

1. Backboard and Equipment Racks

a. Backboards and equipment racks shall be labeled by the Contractor identifying the telecommunication room. Additionally, equipment racks shall have an alpha character after the room number unique to that particular communications closet.

b. Character height shall be 1-inch (minimum).

2. Cabling

a. Horizontal cables shall have a machine generated wrap around cable label within 4" of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standards. Character height shall be .25" (minimum).

b. Voice/data/video backbone cables shall have a machine generated wrap around cable label within 12" of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standard. Character height shall be .5" (minimum).

3. Fiber Optic Backbone, Riser Cables, and Termination Components

a. All fiber optic backbone and copper (inter-building, riser, and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable terminates (e.g., equipment room or telecommunications room I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

b. Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

4. Standard Information Outlet (SIO) Faceplates

a. All faceplates shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, the data port number(s) on the data patch panel(s), and the voice cable number(s).

b. Telecommunications outlets are to be labeled (1) on the cover of the assembly and (2) on each cable terminated at that location.

c. Station cables shall be labeled within two inches of the cable end.

5. Surface Mount Boxes

a. All surface mount boxes shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, and the data port number(s) on the data patch panel(s).

b. Surface mount boxes are to be labeled (1) in the designation window of the box, (2) on each cable terminated at that location, and (3) on the ceiling grid directly below the box when installed above accessible ceiling.

c. Cables shall be labeled within two inches of the cable end.

6. Data Patch Panels

a. All data patch panels shall be clearly labeled indicating the telecommunication room number, the data patch panel letter designation, and the data port number on the data patch panel (ports 1 through 48). Each telecommunication room shall start with data patch panel 'A' and continue through the alphabet.

b. A data port schedule for each telecommunication room shall be created in spreadsheet format (Excel) with the telecommunication room number, data patch panel letter designations, data port numbers, and room numbers identified in the spreadsheet. In addition, for each data patch panel port, a field shall be provided in the spreadsheet for the Owner to manage the cabling infrastructure by recording the device and any special notes pertaining to the room utilizing the data cable terminated to the port.

c. Refer to Telecommunication "T" Series Project Drawings for standard information outlet faceplate and data & voice patch panel labeling scheme requirements. A sample of the data and voice port schedules is to be provided to the Owner, in the cable record book and in electronic format (Excel spreadsheet), with final documents provided on the Project Drawings.

7. Fiber Optic Cables and Termination Components

a. All fiber optic cables, termination enclosures and connector panels, and splice closures shall be clearly labeled.

b. In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

c. Each fiber optic termination panel shall be clearly labeled indicating (1) the destination(s) of the cable(s) and (2) fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

8. Labeling for Backbone Fiber and Outside Plant

a. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read.

b. Descriptive identifiers shall include a combination of the following:

i. Identify the item that the fiber is traveling to by name.

ii. Identify the fiber count and mode.

iii. Identify the direction the majority of the fiber optic cable travels from a handhole/manhole.

c. Labels should be visible during the installation of and normal maintenance of the infrastructure. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat or ultraviolet light) and should have a design life equal to or greater than that of the labeled component.

d. Each cable shall be labeled within 18 inches from the end of the splice enclosure.

e. Each cable is to be labeled within 18 inches from the end of the conduits. In addition, labels shall be affixed to conduit at every transition of a vault, hand hole, riser closet, or major pull box. Labels will be in the form of “HUB Location one-Location two- fiber strands#”. For example, cable sheath from the Campus MDF to Manhole 8C would be labeled as "Campus MDF-MH8C-12.” For example, in the assist handholes/manholes, the cables shall be labeled as “HH South to MH08 North for Veterans.”

f. The following provisions shall apply to labeling Fiber Distribution Components:

i. Label the front of the patch panels with the fiber optic cable number, direction, and fiber count.

ii. Each fiber optic strand shall be labeled with a unique identifier at the LC coupler in the fiber optic patch panel. Connectors shall be labeled on the identifying sheets on the front of the fiber optic patch panel.

iii. Label the front of the splice panels with the fiber optic cable number, direction, and fiber count.

iv. Label splice trays/splice wheels with the cable ID and fiber numbers contained in the tray/wheel.

9. Ground System Labeling

10. All grounds shall be labeled as close as practical to the point of termination (for ease of access to read the label). Labels shall be nonmetallic and include the following statement: “WARNING: If this connector or cable is loose or must be removed, please call the building telecommunications manger.” Refer to ANSI/TIA/EIA 606 for additional labeling requirements.

3.09 TESTING AND ACCEPTANCE

A. The Contractor shall perform acceptance tests as indicated below for each subsystem (backbone, station, etc.) as it is completed.

B. The Contractor shall supply all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type, including equipment to use, setup, test frequencies or wavelengths, results format, etc. The Consultant will approve the method of testing.

C. The Contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The Contractor shall provide the Consultant with a written certification that this inspection has been made.

D. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Consultant. Representatives of the Owner may be in attendance to witness the test procedures. The Contractor shall provide a minimum of one (1) week advance notice to the Consultant and Owner to allow for such participation. The notification shall include a written

description of the proposed conduct of the tests, including copies of blank test result sheets to be used.

E. Tests related to connected equipment of others shall be done only with the permission and presence of Contractor involved. The Contractor shall ascertain that testing only as required to prove the wiring connections are correct.

F. The Contractor shall provide Consultant with test results and descriptions of the testing methodology, including the date of the tests, the equipment used, and the procedures followed. At the request of the Consultant, the Contractor shall provide copies of the original test results.

G. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the Contractor's expense. The applicable tests shall then be repeated.

H. Backbone voice cables shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g., 110). Any mispositioned pairs shall be identified and corrected. The percentage of "bad" pairs shall not exceed 1% in any backbone (riser or tie) cable based on total pair count. All bad pairs shall be identified and documented.

I. The Consultant or Owner may request that a 10% random field re-test be conducted on the cable system to verify documented findings.

1. If requested, the Contractor shall test up to 10% of cable links at no cost to the Owner.

2. Tests shall be a repeat of those defined above and under Testing and Acceptance. If findings contradict the documentation submitted by the Contractor, additional testing shall be performed to the extent determined necessary by the Consultant, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.10 FIRE STOPPING

A. Contractor shall seal any openings created for cable pass-through between floors or through fire rated walls. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Creation of such openings as are necessary for cable passage between locations as shown on the Drawings shall be the responsibility of the Contractor. Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.

End of Section

SECTION 27 0526 – GROUNDING AND BONDING FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

O. Section 27 66 00 – Intrusion Detection System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. IEEE C2 - National Electrical Safely Code

B. IEEE Std. 837-2002, or latest version – Standard for Qualifying Permanent Connections Used in Substation Grounding

C. ANSI/TIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications

D. NFPA 70E - Standard for Electrical Safely in the Workplace

E. ANSI/NECA/BICSI-607 - Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings

F. UL 467 - Standard for Grounding and Bonding Equipment

G. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Provide a comprehensive Communications submittal package; refer to 27 05 00 Communications General Requirements for detailed requirements. Do not provide a separate submittal for this section on its own.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 GROUNDING AND BONDING CABLE

A. The grounding and bonding cable shall be stranded copper conductors.

B. The grounding and bonding cables shall have a green jacket color and riser or plenum rated as required.

C. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications, or as required by NFPA 70, whichever is larger. Differentiate between normal ground and isolated ground when both are used within the same facility.

D. The TBB shall be sized in accordance to the following table:

Linear Length – ft.	Size (AWG)
Less than 13	6
14 - 20	4
21 - 26	3
27 - 33	2
34 - 41	1
42 - 52	1/0
53 - 66	2/0

Greater than 67’	3/0

2.03 GROUNDING AND BONDING BUSBARS

A. Primary Bonding Busbar (PBB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
2. 0.25” thick x 4” wide
3. Sized for current applications and future growth, no less than 20”
4. Insulated from its support
5. Shall be an electro-tin plated busbar
6. Maintain a minimum of 2” of clearance from wall
7. UL listed and BICSI certified

B. Secondary Bonding Busbar (SBB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
2. 0.25” thick x 4” wide
3. Sized for current applications and future growth, no less than 12”
4. Insulated from its support
5. Shall be an electro-tin plated busbar
6. Maintain a minimum of 2” of clearance from wall
7. UL listed and BICSI certified

C. Horizontal Equipment Rack or Cabinet Busbar

1. Mounts to standard 19” Rack or Frame
2. Capacity: 6 Double hole lugs
3. Shall be an electro-tin plated busbar
4. UL listed and BICSI certified

D. Vertical Equipment Rack or Cabinet Busbar

1. Mounts to vertical rail or inside of cabinet in 19” or 23” equipment rack or frame.
2. Capacity: 9 Double hole lugs
3. Shall be an electro-tin plated busbar
4. UL listed and BICSI certified

2.04 MECHANICAL CONNECTORS

A. Mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers, and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are not allowed.

C. Connectors shall meet or exceed UL 467.

2.05 COMPRESSION LUGS

A. Shall be UL & CSA listed

B. Shall meet or exceed the performance requirements of IEEE 837, latest revision

C. Compression type

D. Shall be manufactured from pure wrought copper. Conductivity of this material shall be no less than 99% by IACS standards.

E. Shall be electro-tin plated

F. Lugs shall be 2-hole. Single hole lugs are not allowed

G. Long barrel that will allow a minimum of two crimps with standard industry colors

H. Each connector shall be filled with an oxide-inhibiting compound

I. Crimped with a compression, tool and die system, according to manufacturer's recommendation

2.06 TAPS

A. Connections to the Conductor shall be made with irreversible compression connectors

B. Shall be UL & CSA listed

C. Requires a minimum of (2) crimps for C Tap or H Tap, 1 crimp for I-Beam and busbar Tap

D. Crimp according to manufacturer's recommendation

PART 3 - EXECUTION

3.01 GENERAL

A. Install products in accordance with manufacturer's recommendations.

B. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

C. Mechanical connections shall be accessible for inspection and maintenance.

D. No insulation shall be installed over mechanical ground connections.

E. Ground connection surfaces shall be cleaned and all connections shall be made so that disconnection or removal is impossible.

3.02 RESISTANCE MEASUREMENT

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms.

3.03 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. While the TBB will carry some current under ac power ground fault conditions, it is not intended to provide the only ground fault return path.

B. The TBB shall:

1. Be connected to the PBB & SBB.

2. Be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG.

3. The TBB conductors shall be installed and protected from physical and mechanical damage.

4. The TBB conductors should be installed without splices.

a. Where splices are necessary, the number of splices should be kept to a minimum and they shall be accessible and located within telecommunications spaces or j-box labeled as a telecommunications bonding backbone splice.

b. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors or equal.

C. A metallic cable shield shall not be used as a TBB.

3.04 BACKBONE BONDING CONDUCTOR (BBC)

A. The GE shall be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The GE shall match the size of the TBB.

B. The GE shall connect to the telecommunications grounding busbar(s) in the same-floor telecommunications rooms on the first, top, and every third floor in a building greater than 4 floors.

C. A metallic cable shield shall not be used as a GE.

3.05 TELECOMMUNICATIONS EQUIPMENT BONDING CONDUCTOR (TEBC)

A. Connects the PBB/SBB to equipment racks and cabinets.

B. Shall be a continuous copper conductor that shall be sized per the length of cable.

C. Shall be separated from ferrous materials by 2” or be bonded to the ferrous metal.

D. May be routed within cable trays or suspended 2” under or off the side of the cable tray or ladder rack.

E. Shall be supported every 3ft.

F. 8” minimum bend radius.

G. May come cross other cable groups at a 90 degree angle only.

H. A metallic cable shield shall not be used as a TEBC.

3.06 RACK OR CABINET BONDING CONDUCTOR

A. A bonding conductor shall be used to connect the equipment racks and cabinets directly to the PBB, SBB or underfloor ground mesh network.

B. All metallic enclosures, including remote mounted equipment cabinets and racks for telecommunications, security or audio/visual shall be bonded to the nearest PBB or SBB using a minimum sized conductor of 6 AWG. Remote bonds shall be labeled on both ends stating the destination of the bond.

3.07 ELECTRICAL DISTRIBUTION PANEL (EDP)

A. The AC EDP serving the Telecommunications Room shall be bonded to the PBB or SBB using a minimum of a 6 AWG cable.

B. A qualified electrician shall make all connections within an AC electrical distribution panel.

3.08 OPTICAL FIBER CONDUCTIVE CABLES

A. Conductive fiber-optic cables should be bonded and grounded as specified in the NEC.

3.09 CONDUIT AND SLEEVE BONDING

A. All conduits and sleeves entering a telecommunications room shall be grounded.

3.10 LADDER RACK AND/OR CABLE TRAY

A. All low voltage cable runway sections shall be bonded together and bonded back to the nearest Telecommunications Room the runway is serving as close PBB or SBB as practical.

B. Maintain an 8” minimum bend radius on the TEBC.

C. Keep a 2” separation from other cables both power and telecommunications.

D. Remove any paint, oxidation, etc. from the runway surfaces that are being bonded.

E. Drill two holes as required to accommodate the 2-hole compression lug.

F. Apply a thin coat of antioxidant around the holes and on the surface where the lug will be in contact.

G. Attach straps to the runway using stainless steel hardware sized for the lug holes.

H. Wipe off any excess antioxidant after installation of the lug.

3.11 BUILDING STEEL

A. Each ground bus bar shall be bonded to building steel.

B. Remove any paint or fire stopping spray from the building steel.

C. Provide the appropriate bonding connector to connect to beams, trusses or other types of structure.

3.12 LABELING

A. Refer to Section 27 05 00 for additional requirements

B. Each grounding/bonding cable shall be labeled at the PBB or SBB.

C. All taps to the TBB shall be within an enclosure and labeled as to its purpose.

D. Mechanical connectors shall be clearly marked with the catalog number, conductor size, and manufacturer.

E. Compression lugs shall be clearly marked with manufacturer, catalog number, conductor size, and required compression tool settings.

3.13 TESTING

A. Refer to Section 27 00 00 for additional requirements.

B. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

3.14 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.15 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

End of Section

SECTION 27 0528 – PATHWAYS FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

O. Section 27 66 00 – Intrusion Detection System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 WIRE BASKET TRAY RUNWAY

A. As shown on the Project Drawings, the Contractor shall provide and install sufficient wire basket tray runway systems to support horizontal cable bundles.

B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket tray runway systems.

C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. Contractor shall ensure that all straight section longitudinal wires are installed with no bends, kinks, or twisting.

F. Wire basket runway 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 wire ends along runway sides (flanges) shall be rounded during manufacturing to prevent damage to cables and injury to installers.

G. All fittings shall be field formed as needed.

H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

I. Wire Basket Tray shall be grounded only at the Telecommunications Room ground bus bar.

J. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray to tray or tray to conduit or sleeve of varying elevations the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

K. T-sections of tray shall be made using T-section fittings.

L. Straight section splices shall be made using splice plates.

M. Wire basket runway supports shall be of the trapeze hanger type.

N. Trapeze hangers shall be supported by 3/8 inch diameter rods.

O. Tray shall have an electro zinc finish or a flat Black finish wherever finished installation will be visible to end users.

P. Accessories (connectors, splice plates…) shall be painted to match tray finish.

Q. Contractor shall refer to project drawings for cable tray sizing.

R. Manufacturer: Cable trays and accessories shall be of one of the following manufacturers

1. Cooper B-Line
2. Legrand Cablofil
3. Pentair Hoffman
4. Or approved equal

2.03 CABLE HOOK SYSTEMS

A. In the areas where the cables are required to be run in a “free-air” plenum, a cable hook system shall be used.

B. Cable hooks shall be capable of supporting a minimum of 30 lbs. with a safety factor of 3.

C. Spring steel cable hooks shall be capable of supporting a minimum of 100 lbs. with a safety factor of 3 where extra strength is required.

D. Cable hooks shall be Category 6a or better rated.

E. Follow manufacturer’s recommendations for allowable fill capacity for each size of cable hook.

F. Installation and configuration shall conform to the requirements of the ANSI/ EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

G. Cable hooks shall:

1. Have a flat bottom and provide a minimum of 1 5/16" cable bearing surface.
2. Have 90-degree radiused edges to prevent damage while installing cables.
3. Be designed so the mounting hardware is recessed to prevent cable damage.
4. Have a steel cable latch retainer to provide containment of cables within the hook.
5. Have a retainer that shall be removable and reusable.
6. Be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, and floor posts, to meet job conditions.

H. Factory assembled multi-tiered cable hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed.

I. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653 G90. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.

J. Cable hooks for corrosive areas shall be stainless steel, AISI type 304.

K. Cable hooks shall be B-Line series BCH21, BCH32 or other manufacturer that meets these specifications

2.04 SURFACE RACEWAY

A. In areas where surface raceway will be used as a cable path, no exposed cable shall be permitted.

B. With the agreement of the Consultant and Owner, where telecommunications outlets are to be located in areas where the walls cannot be fished, the station wire serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, conference rooms, or like facilities. Contractor shall attempt to fish hollow walls, use existing conduit, or exhaust all other options to conceal cabling prior to installing surface raceway.

C. The raceway shall originate from a surface mounted box located off the floor, be attached to the wall, and terminate above the ceiling. The outlet box height shall match existing electrical receptacle height. Raceway for wall-mounted phone locations shall originate from a surface mounted box with the top of the box located 48" off the floor.

D. Raceway finish shall match finish of project electrical raceway. All fittings including but not limited to extension boxes, elbows, tees, and fixture boxes shall match the color of the raceway.

E. Telecommunication outlet faceplates shall match electrical faceplate standards for finish.

F. The raceway and all system devices shall be UL listed, exhibit nonflammable self-extinguishing characteristics, tested to specifications of UL94V-0, and be Category Compliant as defined by TIA/EIA 568.

G. Raceway turns or bends shall conform to manufacturer specifications or recommendations and industry best-practices for UTP and fiber optic cable minimum bend radius.

H. Non-Metallic raceway systems:

1. Non-metallic surface raceway shall have an adhesive-applied base and have a hinged snap-on cover. The raceway shall be manufactured of natural PVC compounds.

2. The raceway system shall be made up of the following components:

a. Raceway channel shall be Panduit LD5.

b. Surface mount outlet boxes shall be Panduit JBX3510EI-A.

c. Dropped ceiling connectors shall be Panduit DCF5EI-X or DCEFXEI-X.

d. Right angle fittings shall be Panduit RAFC5EI-X.

e. Coupler fittings shall be Panduit CFX5EI-X.

I. All raceway systems shall be installed complete as specified herein and in manufacturer recommendations.

2.05 CABLE PATHWAY SLEEVES

A. The Contractor shall only provide when re-enterable sleeves are not possible.

B. The Contractor shall provide all necessary wall penetration for cable pathways whether or not specifically shown on Project Drawings.

C. All wall penetrations shall have metallic sleeve(s) as required to maintain a maximum 40% fill ratio and capacity for 25% future growth.

D. All sleeves shall be properly firestopped by this Contractor.

E. Contractor shall provide all core holes, pathways and sleeves (minimum 1.25" c).

F. Contractor shall install non-metallic threadless insulating bushings on end of all conduits.

G. Conduit Core Holes and Sleeves thru Floor: For all floor penetrations, Contractor shall provide IMC conduits with threaded steel couplings set flush with finish floor. Extend 6” above finish floor with IMC before any termination.

2.06 RE-ENTERABLE FIRESTOP SLEEVES

A. Device modules comprised of steel pathway with self-adjusting intumescent foam pads/membrane allowing 0 to 100 percent visual cable fill.

B. Refer to the drawings for required sizes. If not specifically identified, utilize 2” or greater as required for cabling counts with 20% additional capacity for future growth.

C. Manufacturer:

1. STI EZ Path
2. Hilti Speedsleeve
3. Or approved equal

2.07 METAL CONDUITS AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-E.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
    a. Fittings for EMT:
        i. Material: Steel
        ii. Type: Setscrew

6. Expansion Fittings: Steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.08 OUTLET BOXES

A. General Requirements for Outlet Boxes

1. Comply with TIA-569-E.

B. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16'' thick.

C. The dimensions of the metallic outlet box shall be 2''x4'', 4''x4'' and 6''x4'' with a minimum depth of 2.5''. See drawings for details.

D. Metallic outlet boxes shall be equipped with single device cover (or two-device cover where needed).

E. Where installed in plaster, gypsum board, etc., covers shall be raised to compensate the thickness of the wall.

F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

G. Where metallic outlet boxes are to be empty for future use, blank covers shall be used.

H. Gangable boxes are not allowed.

2.09 PAINTING

A. The Contractor is responsible for painting all exposed pathway, boxes, fittings, etc. The paint shall match the surrounding conditions and may change mid-run.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.02 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.03 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.04 WIRE BASKET TRAY RUNWAY

A. Basket tray shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation of wire basket runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing wire basket runways to permit access for installing and maintaining cables.

D. Test wire basket runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

3.05 CABLE HOOK SYSTEM

A. J-hooks fabricated to contain data/voice and video cables may be used to support 25 or fewer cables in each hook. J-hooks are to be fastened to building steel with beam clamps, suspended from ceiling slab with threaded rod, or anchored to the wall. All J-hooks shall be hung straight and level. No other installation technique will be authorized unless pre-approved.

B. Three tiered double-sided J-hook configurations shall contain a maximum of 25 cables per hook or 150 cables. Smaller configurations may be used as bundles decrease in size, maintaining no more than 25 cables per hook.

C. Bundles surpassing 150 cables shall be supported by hangers, fabricated of 3/8” threaded rod and 24” Unistrut. Hangers shall also be installed where the installation of a three-tiered J-hook system is not appropriate for the ceiling space, or where blocked by other trades’ work.

D. Cable bundles consisting of fewer than 10 cables may be supported by single J hooks.

E. All cable support in the main cable path shall be installed every four feet. Small cable bundles (under 25) not in the main path may be supported every five feet.

F. A sag shall be maintained between supports of 6”, to reduce cable strain. Velcro is an appropriate method of securing cables, when properly used and not over tightened.

G. Proper cable support is extremely important to the Owner, and care shall be taken by the Contractor to provide and install the appropriate supports. Supports found to be inadequate will be replaced.

H. Cable bundles including voice/data cabling shall not have plastic cable ties.

I. All cable trunks shall have radius controlled cable waterfalls where trunk drops from conduit, sleeve or tray from horizontal path to vertical path.

3.06 SURFACE RACEWAY SYSTEM

A. In areas where surface raceway will be used as a cable path, no exposed cable shall be permitted.

B. With the agreement of the Consultant and Owner, if a telecommunications outlet is required in an area where the walls cannot be fished, the station cable serving these outlets shall be covered with raceway. No exposed cable shall be permitted within offices, laboratories, and conference rooms, or like facilities. Contractor shall attempt to fish hollow walls, use existing conduit, or exhaust all other options to conceal cabling prior to installing surface raceway.

C. The raceway shall originate from a surface mounted box located off the floor and be attached to the wall and terminate above the ceiling. The outlet box height shall match existing electrical receptacle height. Raceway for a wall-mounted location shall originate from a surface mounted box with the top of the box located 48" off the floor.

D. Minimum bend radius shall be adhered to for UTP and fiber optic cable.

E. Where raceway is to be installed on painted, smooth, finished surfaces, the Contractor shall clean surface prior to installing raceway.

F. Where non-metallic raceway is to be installed on non-smooth surfaces such as wallpaper, unpainted brick, concrete, etc., the Contractor shall use flat-head screws in addition to the adhesive backing to fasten channel to surfaces.

G. Where Contractor is required to install metallic raceway, the raceway base shall be installed using flat-head screws and following all manufacturer's recommendations.

H. Where new outlet locations are indicated on Project Drawings as having existing Wiremold™ type raceway, the Contractor shall remove existing raceway from wall and install new specified raceway to cover any damage or markings caused from removing existing raceway product.

I. All surface raceway shall be mounted level and plumb. Where the Owner considers raceway channels to be installed unsatisfactorily, the Contractor shall remove and replace necessary channels at no additional cost to the Owner.

J. Suitable insulating bushings and inserts shall be used at connections to outlets and corner fittings. Dropped ceiling end fittings shall be utilized where raceway channel connects to dropped accessible ceiling tile. In rooms with drywall ceilings, open ceilings, or non-accessible ceilings, the Contractor shall extend raceway to the nearest location, hallway, or corridor that has accessible ceiling cavity. All cables shall be concealed.

3.07 PATHWAY APPLICATIONS

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT

2. Concealed in Ceilings and Interior Walls and Partitions: EMT

B. Minimum Pathway Size for Data: 1-inch trade size. Cable fill shall not exceed a 40% fill ratio.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.

3.08 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-E for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches of enclosures to which attached.

H. All conduit penetrations shall comply with all applicable fire codes. All conduit penetrations in fire-rated walls or floors shall be sealed and fire proofed to at least the rating of the penetration area.

I. Conduits shall be routed in the most direct route, with the fewest number of bends.

J. There shall be no continuous conduit sections longer than 100 feet. For runs that total more than 100 feet, insert junction or pull boxes (or gutters if appropriate) so that no continuous run between pull boxes is greater than 100 feet.

K. There shall be no more than two 90-degree bends (180 degrees total) between conduit pull boxes.

L. Changes in direction shall be accomplished with sweeping bends observing minimum bend radius requirements above. Do not use pull boxes for direction changes unless specifically designated otherwise in the Drawings.

M. Stub-ups to Above Recessed Ceilings:

1. Use EMT for pathways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

O. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

R. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb. tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

3.09 OUTLET BOXES

A. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

B. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

C. The approximate locations of the outlets are indicated on the drawings. The exact locations shall be determined at the building. The right is reserved to change without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

D. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a rain tight connection between box and cover plate or supported equipment and box.

E. Horizontally separate boxes by a minimum of 12'' mounted on opposite sides of walls so they are not in the same vertical channel.

F. Outlet boxes installed back to back in fire-rated walls shall be separated horizontally by a minimum of 24''.

G. Install all outlet boxes in finished areas flush with the wall. Maintain ¼'' or less space between outlet box front and finished wall surface.

H. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

I. Outlet boxes shall be firmly anchored in place and shall not depend on the cover plate to hold it secure to the wall.

J. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

K. Any surface boxes shall have rounded corners and edges. Surface boxes must be approved by Owner prior to installation.

3.10 RISER CONDUITS

A. Conduits entering equipment rooms shall be reamed or bushed and terminated not more than 4" from a wall and within 12” of room corners.

B. Conduits entering equipment rooms from below floor shall be terminated not more than 4" above finished floor.

C. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12” increments rated at a minimum 1200 pound test.

D. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction.

E. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).

3.11 SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.12 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

End of Section

SECTION 27 0537 – FIRESTOPPING FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. All penetrations of walls shall be approved by the General Contractor before any penetrations are made. Should the Contractor find it necessary to penetrate any walls extending to the slab, it will be the responsibility of that Contractor to provide satisfactory sleeving and fire caulking both inside and outside of that sleeving. If existing sleeving is to be utilized, it will be the responsibility of the Contractor to fire caulk inside the sleeving.

B. Refer to Section 27 00 00 for additional project scope information.

1.02 RELATED WORK

A. Division 7 - Firestopping

B. Section 27 00 00 – General Technology Requirements

C. Section 27 05 00 – Communications General Requirements

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 05 28 – Pathways for Technology Systems

F. Section 27 05 37 – Firestopping for Technology Systems

G. Section 27 11 00 – Communications Equipment Rooms

H. Section 27 13 00 – Communications Backbone Cabling

I. Section 27 15 00 – Communications Horizontal Cabling

J. Section 27 18 00 – Communications Labeling and Identification

K. Section 27 40 00 – AV/Multimedia General Requirements

L. Section 27 41 00 – Audio Visual Systems

M. Section 27 51 00 – Distributed Communications Systems

N. Section 27 60 00 – Physical Security General Requirements

O. Section 27 62 00 – Electronic Access Control System

P. Section 27 64 00 – Video Surveillance System

Q. Section 27 66 00 – Intrusion Detection System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. ANSI/TIA-EIA-569-D “Telecommunications Pathways and Spaces”

B. ASTM E90, “Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements”.

C. ASTM E814, “Fire Tests of Through Penetration Firestops”.

D. ASTM E1725, “Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components”.

E. CAN/ULC S115, "Standard Method of Fire Tests of Firestops Systems."

F. UL 1479, “Fire Tests of Through Penetration Firestops”.

G. National Fire Protection Association (NFPA) – NFPA 101: Life Safety Code.

H. National Fire Protection Association (NFPA) – NFPA 70: National Electrical Code.

I. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

J. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 GENERAL PERFORMANCE REQUIREMENTS

A. Fire rated cable pathway devices shall be used in fire-rated construction for all low-voltage or optical fiber raceways. Such devices shall:

1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.

2. Be tested for the surrounding construction and cable types involved.

3. Re-enterable firestop pathway shall have UL Systems permitting cable loads from zero to 100% visual fill.

4. Re-enterable firestop pathway shall be maintenance-free as defined by not requiring the removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.

5. Pathways shall be engineered such that two or more devices may be ganged together for additional cable capacities.

6. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

7. Size as shown on the drawings or as required when not specifically identified.

B. Non-rated cable pathway devices shall be used in non-fire-rated construction such as smoke partitions for all low-voltage and fiber optic cabling where frequent cable moves, adds and changes may occur. Such devices shall:

1. Limit the movement of smoke and sound of wall and or floor penetrated.

2. Restore the STC Rating of the penetrated assembly.

3. Provide L Ratings of greater than 1 CFM when empty and greater than 2.5 CFM at all other loading up to 100 percent.

4. Accommodate cable loads from zero to 100% visual fill.

5. Be maintenance-free as defined by not requiring the removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.

6. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.

7. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.

8. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

C. Where non-mechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.

D. Cable tray shall terminate at each barrier and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier.

E. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.03 MATERIALS

A. General: Use only products that have been tested for specific fire resistance rated construction conditions or acoustical and smoke related requirements conforming to construction assembly type, penetrating item type, annular space requirements, and rating involved for each separate instance.

B. Firestop Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) SpecSeal Series SSS or LCI Sealant.

b. Hilti

C. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) SpecSeal Series SSP Putty.

b. Hilti

D. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) SpecSeal Series SSB Pillows.

b. Hilti

E. Fire-Rated Cable Grommet: Molded, two-piece grommet with an integral fire and smoke sealing foam membrane for sealing individual cable penetrations through framed wall assemblies.

1. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) EZ-Firestop Grommets.

b. Hilti

F. Fire-Rated Cable Re-Enterable Pathways: Device modules comprised of steel pathway with self-adjusting intumescent foam pads or fabric ring allowing 0 to 100 percent cable fill.

1. Provide with radius control modules (waterfalls) by pathway manufacturer.

2. Acceptable Manufacturers:

a. Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway.

b. Hilti Speed Sleeve

G. Smoke and Acoustical Pathways: Device module comprised of a nonmetallic pathway with integral self-adjusting smoke and sound sealing system for cable penetrations through non-fire-resistance rated wall or floor assemblies

1. Acceptable Manufacturers:

    a. Specified Technologies Inc. (STI) EZ-PATH Smoke & Acoustical Pathway.

    b. Hilti

H. Protective Wrap: Endothermic Wrap incorporating foil scrim for protection of cable pathways, through-penetration and membrane-penetration firestopping, Electrical Metallic Tubing (EMT), Rigid Metallic Conduit (RMC), or Cable Trays.

1. Acceptable Manufacturers:

    a. Specified Technologies, Inc. (STI) E-Wrap™ Endothermic Wrap

    b. Hilti

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.02 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.03 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.04 INSTALLATION

A. Install systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified or required.

B. Comply with manufacturer's instructions for installation of products.

C. Place system stickers on each side of wall penetrations.

D. Place a reproduction (photo copy) of the UL System description in a document protector and mount to the wall next to the wall penetration. Highlight the section of the system description that list the allowed cable types.

E. Do not install products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

F. Do not install products when substrates are wet due to rain, frost, condensation, or other causes.

G. Do not use materials that contain flammable solvents.

H. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to requirements.

I. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

3.05 SCHEDULES

Penetrant Type	Concrete Floor	Concrete Wall	Gypsum Board Wall
Blank Opening	C-AJ-0100, C-AJ-0101, C-AJ-0113, C-AJ-0116	C-AJ-0100, C-AJ-0101, C-AJ-0113, C-AJ-0116	W-L-0020, W-L-0034
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits and Raceways	C-AJ-2140, C-AJ-2292, F-A-2186, F-A-2210, F-A-2225	C-AJ-2038, C-AJ-2108, C-AJ-2578, C-AJ-2586, W-J-2018, W-J-2076	W-L-2059, W-L-2074, W-L-2093, W-L-2241
Cables	C-AJ-3214, C-AJ-3231, F-A-3015, F-A-3021, F-A-3054	C-AJ-3214, C-AJ-3231, W-J-3098, W-J-3099,W-J-3124, W-J-3150, W-J-3180	W-L-3219, W-L-3248, W-L-3287, W-L-3356, W-L-3377, W-L-3378, W-L-3379, W-L-3390
Cable Trays	C-AJ-3317, C-AJ-8181, C-AJ-4029, F-A-3015, F-A-3037	C-AJ-8181, W-J-4021, W-J-4022, W-J-4033, W-J-3098, W-J-3145, W-J-3158	W-L-3218, W-L-3271, W-L-3286, W-L-3306, W-L-4008, W-L-4029, W-L-4043, W-L-8073

End of Section

SECTION 27 1100 – COMMUNICATIONS EQUIPMENT ROOMS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications cabling, termination components, racks, pathways, telecommunication rooms and related subsystems. Covered systems include the following:

1. Equipment room cable management system and equipment racks
2. Horizontal and backbone cable terminating equipment
3. Telecommunications grounds and related components

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

O. Section 27 66 00 – Intrusion Detection System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Provide a comprehensive Communications submittal package; refer to 27 05 00 Communications General Requirements for detailed requirements. Do not provide a separate submittal for this section on its own.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 CATEGORY 6A PATCH PANELS

A. Cables shall be terminated at the telecommunication closets on high-density modular patch panels incorporating Category 6a jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet specified.

B. Patch panel configuration shall be 48 ports unless noted otherwise.

C. The patch panel shall ANSI/TIA/EIA 568.2-D Category 6a compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.

D. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.

E. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.

F. The patch panel shall have color-coded designation strips to identify cable count.

G. Manufacturers:

1. Leviton Quickport
2. Ortronics Clarity
3. Panduit Netkey
4. CommScope Uniprise

2.03 FIBER OPTIC PATCH PANELS

A. The Contractor shall provide a fiber optic patch panel at each location where a fiber optic cable terminates.

B. All terminated fibers shall be mated to duplex LC couplings mounted on enclosed patch panels. Couplers shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types, including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, and FC by changing panels on which connector couplings are mounted.

C. The patch panel enclosure shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and Drawings, including those not terminated (if applicable), PLUS 50% future growth.

D. The Contractor shall provide all required connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated.

E. Patch panels shall be designed for easy installation, front removal, and expansion of snap-in adapter panels.

F. Patch panels shall be enclosed assemblies affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to protect the connector couplings and fiber optic jumpers.

G. The patch panel's enclosure shall provide for strain relief of incoming cables and shall incorporate radius control mechanisms to limit bending of the fiber to the manufacturer's recommended minimums or 1.2", whichever is larger.

H. Access to the inside of the patch panel enclosure during installation shall be from the front and rear. Panels that require any disassembly of the cabinet to gain entry will not be accepted.

I. All patch panels shall provide protection to both the "facilities" and "user" side of the coupling. The patch panel enclosure shall be configured to require front access only when patching. The incoming cables (backbone, riser, etc.) shall not be accessible from the patching area of the panel. The enclosure shall provide a physical barrier to access of such cables.

J. Fiber optic patch panels shall be Corning PCH-02 in TR/IDF and PCH-4U in MDF or Server Rooms or approved equal.

K. 50-micron LC adaptor panels shall be Corning CCH-CP12-E4 or approved equal.

2.04 CABLE MANAGEMENT SYSTEM

A. The cable management system shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprising 4-post and 2-post floor mount racks, wall mount racks, equipment cabinets and vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius, and providing cable strain relief.

1. 2-Post Equipment Racks

a. The Contractor shall provide and install 2-post adjustable equipment racks to house cable termination components (e.g., copper data and fiber optic) and network electronics (by others) as shown on the drawings. Prior to installation, the Contractor shall coordinate exact placement with Owner.

b. Rack shall be 84" in height and shall be self-supporting.

c. Channel uprights shall be spaced to accommodate industry standard 19" mounting and have pass-through holes with smooth edges to protect cables.

d. Rack shall be constructed of aluminum.

e. Able to support up to 1,500 pounds.

f. Rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per EIA/TIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.

g. Rack shall be supplied with at least 24 spare screws.

h. Rack shall be supplied with a vertical ground bar and #6 AWG ground lug.

i. Manufacturers:

i. Chatsworth #55053-703

ii. Commscope

iii. Panduit

iv. nVent Hoffman

v. Or approved equal.

B. Vertical Cable Management

1. At the telecommunication rooms, vertical cable management shall be furnished and installed to adjacent racks to organize cables on front and rear of telecommunication racks.

2. Vertical cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks.

3. Vertical cable management system shall feature the following:

a. Open cabling section on the rear that provides easy access and routes cable bundles feeding into the back of patch panels and 1 RMU cable guide on the front designed for fanning and managing patch cords.

b. Edge-protected pass-through ports designed for easy routing of cable from front channel to back.

c. Vertical slots along the center separator to allow securing cable bundles neatly with management straps.

d. Door/cover (front only) that is easily opened from the right or left and still easily removed to allow for quick moves, adds, and changes.

e. Movable wire retainers to retain the cables during cover removal.

4. Vertical cable management at the end of rack rows shall be 6”.
5. Vertical cable management between racks shall be 10”
6. Manufacturers:
    a. Chatsworth MCS 30095-703 / 30096-703 or Evolution G2 35521-703 / 35523-703
    b. Commscope VCM-DS-84-6B / VCM-DS-84-10B
    c. Panduit PR2VD06 / PR2VD10
    d. nVent Hoffman CableTek DV6DF7 / DV10DF7
    e. Or approved equal

2.05 POWER DEVICES

A. Refer to Section 27 00 00 for additional requirements.

B. Horizontal PDU, Single Circuit for Network Racks

1. Power strip shall provide 3,840 joules of surge protection.
2. 40-80db of EMI/RFI power conditioning
3. 2 isolated and filtered power banks
4. Contractor shall provide one (1) power strip per rack/cabinet.
5. Power strip shall be rated for 20 amps.
6. Manufacturer:
    a. Tripp-Lite IBAR12-20ULTRA
    b. CyberPower
    c. Or approved equal

2.06 HORIZONTAL CABLE MANAGEMENT

A. Horizontal cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

B. The cable managers shall be provided with movable wire retainers to retain the cables during cover removal and #12-24 mounting screws. An integral strain relief bracket shall be provided on either end of the duct to allow for easy cover placement.

C. Double-Sided horizontal cable managers shall be placed above and below each patch panel.

D. The Contractor shall also supply (1) per 48-port patch panel additional managers for network electronics.

E. Manufacturers:

1. Chatsworth #30530-719
2. Commscope
3. Panduit
4. nVentHoffman
5. Or approved equal.

2.07 TELECOMMUNICATION GROUND

A. The Telecommunication Contractor is responsible for providing an appropriate ground for all racks, trays, and telecommunications equipment installed by this Contractor. Refer to the Grounding and Bonding for Technology Systems specification section.

2.08 WIRE BASKET RUNWAY TRAY

A. Within each Telecommunications Room, the Contractor shall provide and install sufficient wire basket tray to support cable bundles from corridor to equipment racks or as shown on the Project Drawings, this Contractor shall provide and install sufficient basket tray to support cable bundles from corridor to equipment racks or cabinets.

B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket runway systems in the telecommunication closet.

C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All straight section longitudinal wires shall be straight (with no bends).

F. Wire basket runway 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 wire ends along runway sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

G. All fittings shall be field formed as needed.

H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

I. Wire Basket Tray shall be grounded to a Telecommunications Room ground bus bar.

J. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop to the rack, cabinets or ladder rack, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

K. T-sections of tray shall be made using T-section fittings.

L. Straight section splices shall be made using splice plates.

M. Wire basket runway supports shall be wall mounted brackets and trapeze hangers when spanning the room.

N. Trapeze hangers shall be supported by 3/8 inch diameter rods.

O. Provide size as indicated on the drawings.

P. Tray shall have flat Black finish.

Q. Accessories (connectors, splice plates…) shall be painted to match tray finish.

R. Manufacturer:

1. Cooper B-Line
2. Legrand Cablofil
3. Pentair Hoffman
4. Or approved equal

2.09 LADDER RACK

A. Within each Telecommunications Room, the Contractor shall provide and install ladder rack as shown on the Project Drawings.

B. Within each Telecommunications Room with a vertical conduit riser the Contractor shall provide and install vertical ladder rack connecting the ground conduit sleeve penetrations with the ceiling conduit sleeve penetrations.

C. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install a complete ladder rack system in the telecommunications room as shown on the Drawings.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel.

F. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop into the racks/cabinets, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

G. Size ladder rack as indicated on the Contract Documents.

H. Accessories (connectors, splice plates…) shall be painted to match tray finish.

I. Manufacturers:

1. Chatsworth
2. Cooper
3. Legrand
4. Pentair Hoffman
5. Or approved equal

2.10 PLYWOOD

A. The Contractor shall provide plywood. Plywood shall be installed on all walls within a telecommunications room and other locations as noted.

B. Provide void-free, interior grade, fire rated A-C grade plywood, 3/4” by 48” by 96”, or as indicated.

C. When plywood is required to be painted, the paint shall be UL 723 rated white or gray fire retardant. The plywood’s rating stamp shall be exposed (not painted over) on each sheet. Plywood shall have fire calk around all edges. Provide label including paint manufacturer, date painted, UL listing and name of Installer

D. Plywood shall be mounted vertically starting at 22” AFF to 118” AFF and anchored to all studs.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.02 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.03 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.04 EQUIPMENT RACK AND CABINETS

A. Prior to permanently securing racks or cabinets, the Contractor shall coordinate a walk through with the Owner to determine exact placement of racks.

B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. Rack shall also be stabilized by extending a brace extending to the wall. Alternately, overhead cable tray over which the cabling accesses the equipment rack(s) shall provide this function.

C. A space between the rack upright and the wall (~6") shall be planned to allow for cabling in that area. The rear of the rack shall be ~40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed shall be brought to the attention of the Consultant for resolution prior to installation.

D. All hardware and equipment is to be mounted at least 18" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware shall be reviewed and approved by the Consultant and Site Coordinator(s) prior to installation.

E. Equipment rack shall be equipped with cable management hardware to allow an orderly and secure routing of twisted pair cabling to the data patch panels. At minimum, one such horizontal jumper management panel shall be placed below each fiber optic patch panel installed by the Contractor. Additional jumper management panels may be required pending installation of other cable types on the rack. The rack shall be grounded to the telecommunications grounding backbone (TGB) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket).

3.05 WIRE BASKET TRAY AND LADDER RACK RUNWAY

A. Runway shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation of runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing runways to permit access for installing and maintaining cables.

D. Test runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

End of Section

SECTION 27 1300 – COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications voice, data and video backbone cabling and termination components.

C. Backbone Cabling is the cable and hardware interconnecting telecommunication rooms (TRs), building demarcation rooms, equipment rooms and server rooms. The backbone cabling shall consist of the following cable types:

1. 50-micron Multimode Fiber Optic Cable

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Provide a comprehensive Communications submittal package; refer to 27 05 00 Communications General Requirements for detailed requirements. Do not provide a separate submittal for this section on its own.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.09 TEST DATA – FIBER OPTIC MEDIA

A. The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

B. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test.

C. The database for the completed job shall be stored and delivered on USB flash drive. This USB flash drive shall include the software tools required to view, inspect, and print any selection of test reports.

D. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value as defined in this document).

3. The date and time the test results were saved in the memory of the tester.

E. The following general information is to be provided in the electronic database containing the test result information for each link:

1. The identification of the customer site as specified by the end user.

2. The overall Pass/Fail evaluation of the link-under-test.

3. The name of the standard selected to execute the stored test results.

4. The cable type and the value of the ‘index of refraction’ used for length calculations.

5. The date and time the test results were saved in the memory of the tester.

6. The brand name, model, and serial number of the tester.

7. The revision of the tester software and the revision of the test standards database in the tester.

F. The detailed test results data to be provided in the electronic database for each tested optical fiber shall contain the following information:

1. The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation.

2. The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength, and the margin (difference between the measured attenuation and the test limit value).

G. The link length shall be reported for each optical fiber for which the test limit was calculated.

H. Contractor shall provide accurate as-built Construction Drawings at the site during construction.

I. The Drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (".dwg", AutoCAD rel. 2004 and ".dxf") formats on which as-built construction information can be added. These documents will be modified accordingly by the Contractor to denote as-built information as defined above and returned to the Owner.

J. The Contractors shall annotate the base Drawings and return to the Consultant in hard copy (same plot size as originals) and electronic (AutoCAD rel. 2004 and ".dxf") form.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 BACKBONE VOICE CABLING

A. The voice backbone cable shall link the Main Closet and Telecommunications Rooms serving the building. The cables shall be CMP rated where required.

B. Voice backbone cable shall incorporate 24 AWG solid annealed copper conductors insulated with a polyvinyl chloride skin over expanded polyethylene. Conductors shall be twisted to form pairs and fully color-coded.

C. The voice backbone cable shall be sized as detailed on the Drawings.

D. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of ten (10) distinctive colors to identify 25 pairs in accordance with ICEA publication S-80-576-1988. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.

E. The voice backbone cable shall meet or exceed the EIA/TIA Category 3 performance requirements.

F. When cables of larger than 25 pairs are required, the core shall be assembled into 25-pair subunits, each color-coded in accordance with ICEA publication S-80-576-1988. Cables with over 600 pairs shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow, and violet. Binder color code integrity shall be maintained wherever cables are spliced.

G. All cables and equipment shall be furnished, installed, wired, and tested by the Contractor.

H. Manufacturers:

1. Belden

2. Berk-Tek
3. General Cable
4. Superior Essex
5. Or approved equal

2.03 TIGHT-BUFFERED OPTICAL FIBER CABLES FOR INDOOR DISTRIBUTION APPLICATIONS

A. General Considerations

1. The cable shall meet the requirements of the National Electrical Code (NEC) Section 770.
2. For plenum applications, the cable shall meet applicable flame tests: ANSI/UL 910 (NFPA 262-1994).
3. Finished cables shall conform to the applicable performance requirements of Tables 8-6 and 8-7 of the Insulated Cable Consultants Association, Inc. (ICEA) *Standard for Fiber Optic Premises Distribution Cable* (ICEA S-83-596).

B. Cable Construction

1. The coated fiber shall have a layer of Teflon placed between the acrylate coating of the optical fiber and the thermoplastic buffer. The diameter of the thermoplastic buffer coating shall be 900 ±50µm. The fiber coating and buffer shall be removable with commercially available stripping tools in a single pass for connectorization or splicing.
2. Cables with 2 to 24 fibers layered aramid yarns shall serve as the tensile strength member of the cable.
3. A ripcord shall be applied between the aramid yarns and the outer jacket to facilitate jacket removal.
4. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.
5. The fibers shall be stranded around a dielectric central member.
6. For cables containing 12-24 fibers, the fibers shall be arranged in two layers.
7. The central member shall be over coated with a thermoplastic, when required, to achieve dimensional sizing to accommodate and support the 900 µm buffered fibers.
8. Cables with 24 to 60 fibers shall have unitized riser and plenum constructions.
9. The buffered fibers shall be grouped in six-fiber subunits.
10. The fibers shall be stranded around a dielectric central member in the subunit.
11. Layered aramid yarns shall serve as the tensile strength member of the subunit.
12. A ripcord may be applied between the aramid yarns and the subunit jacket to facilitate jacket removal.

13. The subunit jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.

14. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the subunits. The strength members shall be of a high modulus aramid yarn. The aramid yarns shall be helically stranded around the buffered fibers. Non-toxic, non-irritant talc shall be applied to the yarns to allow them to be easily separated from the fibers and the subunit jacket.

C. Outer Cable Jacket

1. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand stresses. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, and environmental test requirements of this document over the life of the cable.

2. The indoor distribution cable specified herein shall have an interlocking armor made of steel or aluminum. Provide plenum rated cable as required.

3. The color of the jacket shall match the jacket color of the optical fiber cable located inside of the cable.

D. Fiber Identification

1. The individual fibers shall be color-coded for identification. The optical fiber color-coding shall be in accordance with ANSITIA/EIA-598-B “Optical Fiber Cable Color Coding.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another.

2. When buffered fibers are grouped into individual subunits, each subunit jacket shall be numbered for identification, with the exception of filler subunits where used. The number shall be repeated at regular intervals. The subunit jacket color shall be aqua for subunits containing OM3/4 multimode fibers, yellow for subunits containing singlemode fibers, and white for filler subunits.

3. The outer jacket for all dielectric cable shall be marked with the manufacturer name or UL file number, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall be Aqua for cables containing OM3/4 multimode fibers and yellow for cables containing singlemode fibers.

4. Cables shall be marked with the manufacturer name, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall match the color of the core optical fiber cable.

E. Cable Specifications

1. Temperature Range

a. Non-Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC. The installation/operating temperature range for riser cables shall be -20 to +70 ºC. Testing shall be in accordance with FOTP-3.

b. Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC.The installation/operating temperature range for plenum cables shall be 0 to +70ºC.Testing shall be in accordance with FOTP-3.

2. Compressive Load Resistance

a. When tested in accordance with FOTP-41, Compressive Loading Resistance of Fiber Optic Cables, the cable shall withstand a minimum compressive load of 89 N/cm (50 lbf/in) applied uniformly over the length of the compression plate. While under compressive load, the fiber shall not experience an attenuation change greater than 0.4 dB at 1550 nm (singlemode) or greater than 0.6 dB at 1300 nm (multimode). After the compressive load is removed, the fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

3. Cyclic Flexing

a. When tested in accordance with FOTP-104, Fiber Optic Cable Cyclic Flexing Test, the cable shall withstand 25 mechanical flexing cycles at a rate of 30 ± 1 cycle per minute. The fiber shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

4. High and Low Temperature Bend

a. When tested in accordance with FOTP-37, Fiber Optic Cable Bend Test, Low and High Temperature, the cable shall withstand four full turns around a mandrel at test temperatures of 0 ºC and +50 ºC. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.5 dB at 1300 nm (multimode).

5. Impact Resistance

a. When tested in accordance with FOTP-25, Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies, the cable shall withstand a minimum of 20 impact cycles for riser cables and 10 impact cycles for plenum cables. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

6. Temperature Cycling

a. When tested in accordance with FOTP-3, Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components, the change in attenuation at extreme operational temperatures (0 to +50 ºC) shall not exceed 0.3 dB/km at 1550 nm (singlemode) or 0.6 dB/km at 1300 nm (multimode). The change in attenuation is measured with respect to the baseline values measured at room temperature before temperature cycling.

7. Twist-Bend

    a. When tested in accordance with FOTP-91, Fiber Optic Cable Twist-Bend Test, a length of cable no greater than 2 meters shall withstand 10 cycles of mechanical twisting and bending around a mandrel 20 times the cable outer diameter. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or 0.4 dB at 1300 nm (multimode).

F. Multimode OM4 (50/125 µm)

1. The multimode fiber utilized in the optical fiber cable shall meet EIA/TIA-492AAAA-A-1997, Detail Specification for 50µm Core Diameter/125µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers, unless noted otherwise. Cable shall have the following specifications:

    a. Core Diameter: 50 ± 3 µm

    b. Core Non-Circularity: ≤5%

    c. Cladding Diameter: 125± 2 µm

    d. Cladding Non-Circularity: <2.0%

    e. Core-to-Cladding Concentricity: ≤ 3 µm

    f. Coating Diameter: 245 ± 2 mm

    g. Refractive Index Profile: Graded index

    h. Numerical Aperture: 0.275 ± 0.015

    i. Maximum Attenuation: less than 3.0 dB/km at 850 nm and 1.0 dB/km at 1300 nm.

2. IEEE 802.3ae Performance: The fiber shall support laser-based 10 Gigabit Ethernet (10GbE) operation for up to 550 meters.

3. Attenuation at the Water Peak: The attenuation coefficient at 1380 nm shall not exceed the attenuation coefficient at 1300 nm by more than 1.0 dB/km.

4. Macrobend Attenuation: The attenuation due to 100 turns of fiber around a 75-± 2 mm diameter mandrel shall not exceed 0.5 dB at 850 nm or 1300 nm.

G. The cable shall be manufactured by:

1. Belden

2. Berk-Tek

3. Corning

4. General Cable

5. Or approved equal.

2.04 FIBER OPTIC CONNECTORS

A. The MM optical connector shall be LC UPC type.

B. The connector ferrule shall be ceramic or glass-in-ceramic. The optical fiber within the connector ferrule shall be secured with an adhesive.

C. The attenuation per mated pair shall not exceed 0.35 dB (individual) and 0.2 dB (average). Connectors shall sustain a minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.

D. The connector shall meet the following performance criteria:

1. Cable Retention (FOTP-6) 0.2 dB
2. Durability (FOTP-21) 0.2 dB
3. Impact (FOTP-2) 0.2 dB
4. Thermal Shock (FOTP-3) 0.2 dB
5. Humidity (FOTP-5) 0.2 dB

E. Connectors shall be field terminated and polished or fusion spliced. Mechanical, quick connect or index-gel based connectors are not allowed.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 27 00 00 for additional requirements.

B. Field Test Requirements for Fiber Optic Cabling System

1. The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, the Contractor shall provide cable manufacturer's test report for each reel of cable provided. These test reports shall include the manufacturers on reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.

2. Factory data shall be provided upon request, showing on-the-reel bandwidth performance results as tested at the factory.

3. Every fiber optic backbone link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-C or by the appropriate network application standard(s), whichever is more demanding.

4. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

5. 100% of the installed cabling links shall be tested and shall pass the requirements of the standards mentioned above and as further detailed in this document. Any failing link shall be diagnosed and corrected at no additional cost to the Owner. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with RFP.

6. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

    a. The manufacturer of the fiber optic cable and/or the fiber optic connectors

    b. The manufacturer of the test equipment used for the field certification

    c. Training organizations authorized by BICSI

7. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14-A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-C.1) with a Category 1 light source.

8. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

9. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

10. The fiber optic launch cables and adapters shall be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

11. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.

12. Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

13. A representative of the Owner shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing begins.

14. A representative of the Owner will select a random sample of 5% of the installed links. The results obtained shall be compared to the data provided by the installation Contractor. If more than 2% of the sample results differ in terms of the Pass/Fail determination, the installation Contractor, under supervision of the Owner representative, shall repeat 100% of the testing. The cost of retesting shall be borne by the installation Contractor.

C. Fiber Performance Test Parameters

1. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B.

    a. Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn

    b. Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)

    c. The values for the Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation_Coefficient (dB/km)

Multimode OM4 50/125 µm	850	3.0
	1300	1.5

d. Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)

e. Maximum allowable mated connectors_loss = 0.50 dB

f. Splice_Attn (dB) = number of splices (S) * splice_loss (dB)

g. Maximum allowable splice_loss = 0.1 dB (when tested bidirectionally)

2. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices—i.e., it does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

3. Test equipment that measures the link length and automatically calculates the link loss based on the above formulas is preferred.

4. The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

5. The backbone link (multimode/singlemode) shall be tested in two directions at both operating wavelengths to account for attenuation deltas associated with wavelength.

6. Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A.

7. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.

8. Multimode backbone links are designed to be used with network applications that use laser light sources (underfilled launch conditions). However, the link attenuation equation has been based upon the use of a light source categorized as Category 1, Overfilled.

3.02 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.03 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.04 CABLE SLACK

A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.

B. A minimum of 15 feet of slack cable (each cable) shall be coiled and secured at each end.

C. A minimum of 50 feet of slack cable (each cable) shall be coiled and secured vertically in handholes/manholes used for installation assistance unless otherwise noted in the drawings.

D. A minimum of 100 feet of slack cable shall be provided whenever fiber splice enclosures are required unless otherwise noted in the drawings. This excess slack shall provide added cable for restorations or reconfigurations without digging up large parts of the cable system.

3.05 INSTALLATION PRACTICES FOR FIBER OPTIC CABLE

A. Fiber optic cable is a high-capacity transmission medium with qualities and characteristics, which can be degraded when it is subjected to excessive pulling tension, sharp bends, and crushing forces.

B. The maximum pulling tension for armored cable is 2,700 Newtons (600 lbs.).

C. Maximum long-term crush forces for armored cable are 100N/cm (57.1 lb./in.).

D. The minimum bend radius for an armored cable during installation and following installation over the life span of the cable must be 20 times (20 x) the cable diameter.

E. The minimum diameter required for pull wheels or rollers should be double the minimum bend radius. The Contractor will be responsible to check manufacturer's specifications for the cable feed-chute, to make sure that the chute's critical dimensions and clearances are compatible with the placing cable. The chute must have a 31-inch minimum radius.

3.06 CABLE TERMINATION FOR FIBER OPTIC CABLE

A. All fibers shall be terminated using the specified connector type. No mechanical splice is allowed.

B. All terminated fibers at the Telecommunications Closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.

C. All couplings shall be fitted with a dust cap.

D. Fibers from multiple locations may share a common enclosure; however, they must be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure provided that they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g. "insert").

E. Slack of 15 feet in each fiber cable shall be provided as to allow for future re termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30" high workbench positioned adjacent to the termination enclosure(s). A minimum of 1-meter (~39") of slack shall be retained regardless of panel position relative to the potential work area.

3.07 FIBER OPTIC SYSTEM ACCEPTANCE

A. The fiber optic outside plant system will be accepted by the Owner when:

1. All the work has been completed in accordance with the contract and specifications.

2. The system operates in conformance with manufacturer's published specifications.
3. The system has completed a successful performance period. The performance period will begin on the day following the cutover and must continue for 30 consecutive days during which time the system will operate at an average effectiveness level of 99 percent or more. If for any reason this level cannot be maintained, a new 30-day performance period will be initiated. It is not necessary that one 30-day period expire before another performance period begins.
4. The Contractor has certified in writing to Consultant when the cable is installed, operational in accordance with these specifications, and ready for use.
5. The final step in accepting buried cable installation will be a thorough inspection of the entire route from start to finish. The "as-built" drawings must be submitted to the Owner one week prior to final inspection. The drawings will be examined by Consultant's personnel and involved parties for conformance to Consultant's plans, codes, regulations, and general accuracy.
6. The construction area above ground will be inspected to ensure the following:
7. Restoration has been accomplished.
8. Permanent markers have been installed immediately beside the cables.
9. Road bores, if used, are properly completed and will not collapse a portion of the road.
10. Debris and trash have been removed from the site.
11. Other instructions specific to the installation have been completed to the project manager's specifications.
12. All test results should be submitted in hard copy and in usable (MS Word) electronic format and meet specifications.
13. At this time, upon Owner's written acceptance, operations control becomes the responsibility of the Owner.

SECTION 27 1500 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SCOPE

A. This section describes the products and execution requirements relating to telecommunications voice, data and video horizontal (station) cabling and termination components.

B. Horizontal cabling is the cabling between the work area telecommunications outlet and the telecommunications room (TR). Horizontal cabling is often referred to as “station cabling”.

C. The horizontal cabling system will consist of the following:

1. Unshielded Twisted Pair (UTP) Cable
2. Outlet Termination Modules (jacks)
3. Outlet Termination Plates
4. Horizontal Fiber Optic/Copper Composite Cabling
5. Above Ceiling Cable Support Systems
6. Horizontal Cable Testing Requirements
7. Cable Pathway/Sleeve Requirements

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 13 00 – Communications Backbone Cabling

H. Section 27 40 00 – AV/Multimedia General Requirements

I. Section 27 41 00 – Audio Visual Systems

J. Section 27 51 00 – Distributed Communications Systems

K. Section 27 60 00 – Physical Security General Requirements

L. Section 27 62 00 – Electronic Access Control System

M. Section 27 64 00 – Video Surveillance System

N. Section 27 66 00 – Intrusion Detection System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Provide a comprehensive Communications submittal package; refer to 27 05 00 Communications General Requirements for detailed requirements. Do not provide a separate submittal for this section on its own.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 CATEGORY 6A HORIZONTAL COPPER CABLES

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. This cable shall be utilized and suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.

D. The cable design described herein shall exceed transmission performance of Category 6a cables.

E. Category 6a cables shall be bundled separately from lower Category rated cabling.

F. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

G. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

H. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

I. Manufacturers:

1. Berk-Tek LM-RDT
2. General Cable GenSPEED 10 MTP Gen 5 or later
3. Commscope Uniprise CS44P SD
4. Superior Essex 10Gain XP+

2.03 DATA CABLING COLORS

A. The Contractor shall confirm jack color for the following prior to installation:

1. Standard Data Outlets
2. Wireless Access Points
3. IP Security Devices (Cameras, Access Control Panels, Intercoms, Intrusion Detection Panels, Vape Detectors, etc.)
4. AV Systems

2.04 CATEGORY 6 EXTENDED DISTANCE HORIZONTAL COPPER CABLES

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. This specification defines the requirements for commercially available extended distance Category 6 cable.

D. When utilized for installation free-air, in building risers, in conduit, and/or in cable tray the cable shall carry a CMP rating.

E. When utilized for installation below the building slab in conduit within the building envelope, the cable shall have a CMX/CMP indoor/outdoor rating.

F. When utilized for installation in underground conduit outside of the building envelope the cable shall be gel filled OSP rated for wet environments.

G. The cable shall utilize 22 AWG conductors.

H. The manufacturer shall have custom testing perimeters for extended length cables compatible with the cable certifier utilized on the project. These results shall be submitted with the as-builts.

I. Distance shall be based on 1Gpbs performance at 90 watts of PoE.

J. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

K. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

L. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer and able to accommodate the larger conductors.

M. Manufacturers:

1. Berk-Tek
2. Paige Datacom GameChanger
3. General Cable GenSPEED 6 MAX
4. Commscope Systimax GigaREACH XL
5. Superior Essex PowerWise 1G 4PPoE

2.05 INFORMATION OUTLET

A. General

1. Station cables shall each be terminated at their designated workstation location in the connector types described in the subsections below. Included are modular jacks, faceplates, and surface mount raceway. The combined assembly is referred to as the Standard Information Outlet (SIO). These connector assemblies shall snap into a mounting frame.
2. SIOs shall be mounted in new outlet boxes, where existing boxes are in place, on surface mount raceway typically in surface raceway with barrier, in floor mount interface boxes, or on power poles either currently owned or new.
3. The telecommunications outlet frame shall accommodate or incorporate the following:
    a. A minimum of four (4) modular jacks, when installed on a wall-mounted assembly.
    b. A mechanism for adjusting the surface plate to a plumb position.
4. When multiple jacks are identified in close proximity on the Drawings. The Contractor shall determine the optimum compliant configuration based on the products proposed.
5. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each SIO type for review by the Consultant.

B. Modular Jack

1. Data jacks shall be non-keyed 8-pin modular jacks.

2. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
3. Jacks shall utilize a four-layer printed circuit board to control NEXT.
4. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
5. Modular jack contacts shall accept 2500 plug insertions.
6. Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in two staggered arrays of four to maximize contact spacing and minimize crosstalk.
7. Modular jack contacts shall be constructed of Beryllium copper for maximum spring force and resilience.
8. Contact Plating shall be a minimum of 50 micro inches of gold in the contact area over 50 micro-inch of nickel, compliant with FCC part 68.5.
9. Jack termination shall be 110 IDC, integral to the jack housing, laid out in two arrays of four contacts.
10. Jacks shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
11. Jacks shall utilize tin lead plated (60% tin/40%lead) phosphor bronze 110 insulation displacement contacts.
12. Jacks shall terminate 22-26 AWG stranded or solid conductors.
13. Jacks shall terminate insulated conductors with outside diameters up to .050".
14. Jacks shall be compatible with single conductor 110 impact termination tools.
15. Jacks shall be compatible with EIA/TIA 606 color code labeling and accept snap on icons for identification or designation of applications.
16. Jacks shall be marked as either T568A or T568B wiring.
17. Category 6a jacks shall be manufactured by:
    a. Leviton Atlas-X1
    b. Ortronics Clarity TracJack
    c. Panduit Netkey
    d. CommScope Uniprise

C. Data Jack Colors

1. The color for data jacks shall be:
    a. Standard Data Outlets – BLUE
    b. Wireless Access Points – GREEN

c. IP Security Devices (Cameras, Access Control Panels, Intercoms, Intrusion Detection Panels, Vape Detectors, etc.) – YELLOW

d. AV Systems - PURPLE

D. Outlet Faceplates

1. Faceplates shall match the electrical outlets for material type and color and may vary by location.

2. Faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

4. Modular jacks shall have capability to incorporate a dust cover that fits over and/or into the jack opening. The dust cover shall be designed to remain with the jack assembly when the jack is in use. No damage to the jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the jack pinning shall not be accepted.

5. Wall-mounted “voice only” outlets shall be installed where identified on the floor plan Drawings to accommodate wall-mounted telephone sets. The wall plate shall be of stainless steel construction, accommodate one RJ-45 jack, mount on a standard single gang outlet box or bracket, and include mating lugs for wall phone mounting. Some types of phones may require a horizontal mounting.

6. All standard information outlets and the associated jacks shall be of the same manufacturer throughout each/the building. An allowable exception, however, is the wall-mounted “voice only” outlet described above.

7. Faceplates shall be manufactured by modular jack manufacturer.

E. Surface Mount Interface Box

1. Low profile, surface mount boxes shall incorporate recessed designation strips at the top for identifying labels. Designation strips shall be fitted with clear plastic covers.

2. The box shall feature built-in cable management for both fiber and copper applications.

3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

4. Modular jacks shall have capability to incorporate spring-loaded shutter door for added protection from dust and other airborne contaminants. The dust cover shall be designed to remain with the jack assembly when the jack is in use.

5. The box shall have the capability to incorporate optional magnets that can be internally mounted.

6. Surface mount box shall be manufactured by modular jack manufacturer.

2.06 COMMUNICATIONS PATCH CORDS

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All patch cords shall be round and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted pairs within a flame retardant jacket and be backwards compatible with lower performing categories. Modular patch cords shall utilize ISO termination method that is designed to reduce and control near-end cross talk (NEXT) and far end cross talk (FEXT) without compromising signal impedance.

C. Both ends of the cord shall be equipped with modular 8-position (RJ45 style) plugs wired straight through with standards compliant wiring. All modular plugs shall exceed FCC CFR 47 part 68 subpart F and IEC 603.7 specifications, and have 50 micro inches of gold plating over nickel contacts. Cable shall be label-verifiable. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall have color-coded insert molded strain relief boot with a latch guard to protect against snagging. Additional color-coding shall be available by the use of snap-in icons.

D. Patch cords shall be wired straight through. Pin numbers shall be identical at each end and shall be paired to match T568B patch panel jack wiring per ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed.

E. The patch cords shall match the Category rating of the jack and cable it will be connecting to.

F. Prior to ordering patch cords the Contractor shall schedule meeting with Owner and Consultant to verify patch cord lengths, colors and quantities.

G. Contractor shall coordinate delivery of patch cords with Owner. Contractor shall have list of delivered cords and shall have Owner sign delivery sheet at time of delivery.

H. The manufacturer of the cords shall be the same as the manufacturer for UTP termination hardware (jacks & patch panels) for a complete system. Cords shall be highest quality patch cords available by connectivity manufacturer and match the performance grade of the utilized horizontal cable solution. Exceptions may be acceptable in special circumstances such as OSP or shielded applications and should be included in the submittals for review.

I. Manufacturers:

    1. Leviton/Berk-Tek
    2. Panduit/General Cable
    3. Commscope
    4. Ortronics/Superior Essex

J. Patch Cable Colors

    1. Confirm colors and quantities of each color with Owner prior to order placement.

K. Locations and types of patch cords:

    1. Patch panel / data rack

        a. The Contractor shall provide one patch cord for every terminated jack at the patch panel. These cords shall be turned over to the Owner.

        b. The lengths of the cords shall depend on the rack layout to enable patching in the network switches.

i. In racks where the network switches are stacked at the bottom, below a series of patch panels, or in an adjacent rack, the Contractor shall provide a mixture of 5-foot, 7-foot, and 10-foot or greater patch cords based on the specific distances and layout.

c. Patch cords at the rack shall be non-plenum.

2. Installed network devices

a. The Contractor shall provide one patch cord for every permanently installed IP device, such as a surveillance camera, intercom station, or wireless access point. These cords shall be turned over to whoever is installing the associated device, which may be a different subcontractor, an Owner's vendor, or the Owner's IT department.

b. Outdoor-mounted devices shall receive a shielded patch cord.

c. Patch cords for installed network devices shall be plenum rated.

d. The lengths of the patch cords shall depend on the installation conditions. For example, if the suspended ceiling is very close to the bottom of structure, and a surface-mount interface box is mounted to the structure to support a wireless access point in the ceiling, a 3-foot or 5-foot cord may be appropriate. If there is a large gap between the suspended ceiling and the bottom of structure, then a 7-foot, 10-foot, or even longer cord may be required. The Contractor shall review the specific installation conditions and use that to inform the patch cord lengths.

3. Standard outlets for workstations, printers, telephones, etc.

a. The Contractor shall provide one 10-foot patch cord for every standard data outlet jack. These cords shall be turned over to the Owner.

b. Patch cords for standard data outlets shall be non-plenum.

2.07 FIBER OPTIC PATCH CORDS

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All MM fiber optic patch cords shall:

1. Be duplex 2-3mm tight buffer design with Aqua jacket.

2. Have LC-LC connectors with straight thru connectors (A-A Polarity). Adjust as required for the specific device being connected.

3. Have 50-micron OM4 core.

C. Locations and types of fiber optic patch cords:

1. Installed network devices

a. The Contractor shall provide one patch cord for every contractor furnish and installed network device with SFP or fiber optic connections, such as a fiber optic media converter, remote network switches/power supplies such as those on a pole or exterior enclosure, servers such as a video surveillance server, etc. These cords

shall be turned over to whoever is installing the associated device, which may be a different subcontractor, an Owner's vendor, or the Owner's IT department.

b. The lengths of the patch cords shall depend on the installation conditions. The Contractor shall review the specific installation conditions and use that to inform the patch cord lengths.

2. Fiber optic patch panel / Network Switches

a. The Contractor shall provide one fiber optic patch cord for every network switch or network switch stack. These cords shall be turned over to the Owner.

b. The lengths of the cords shall depend on the rack layout to enable patching in the network switches.

i. In racks where the network switches are stacked at the bottom or in an adjacent rack, the Contractor shall provide a mixture of 5-foot, 7-foot, and 10-foot or greater patch cords based on the specific distances and layout.

c. Patch cords at the rack shall be non-plenum.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.02 TWISTED PAIR TEST EQUIPMENT

A. Test equipment used under this contract shall be from a manufacturer who has a minimum of five years' experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.

B. All test tools of a given type shall be from the same manufacturer and have compatible electronic results output. Test adapter cable shall be approved by the manufacturer of the test equipment. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.

C. Test equipment shall:

1. Be capable of certifying Category 6 and 6A permanent links.

2. Have a dynamic range of at least 100dB to minimized measurement uncertainty.

3. Be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.

4. Include S-band time domain diagnostics for NEXT and return loss.

5. Be capable of running individual NEXT, return loss, etc., measurements in addition to AutoText.

6. Include a library of cable types, stored by major manufacturer.

7. Store at least 1000 Category 6 or 6A autotests in internal memory.

D. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurements.

E. The approved manufacturer of the test equipment is Fluke and JDSU/Viavi.

3.03 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.04 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.05 STATION CABLING

A. Information outlet cables with copper media (voice & data UTP and "TV" coax) shall be located as detailed on the Project Drawings.

B. The Contractor shall utilize these documents in determining materials quantities and routing.

C. Station cables shall be run to the information outlet from the telecommunications room serving each area in conduit, free-air above drop ceiling, in cable tray, and/or in modular furniture.

D. The maximum station cable drop length for UTP cables shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and shall include any slack required for the installation and termination. The Contractor shall install station cabling in a fashion to avoid unnecessarily long runs.

E. Contractor shall verify cable lengths comply with published standards; prior to installation of any horizontal cabling, this Contractor shall verify cable paths and confirm no horizontal cable will exceed 295 total feet. If it is determined that the cable will exceed 295', this Contractor shall route the cabling to another telecommunications room or determine shorter path so cables are under 295'. If this is not possible, the Contractor shall notify the Consultant prior to installation. Failure to do this step will not result in a change order from the Contractor.

F. All cables shall be installed splice-free unless otherwise specified.

G. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

H. Avoid abrasion and other damage to cables during installation.

I. All cable shall be free of tension at both ends. In cases where the cable shall bear some stress, Kellom grips may be used to spread the strain over a longer length of cable.

J. Where installed free-air, installation shall consider the following:

1. Cable shall run at right angles and be kept clear of other trades' work.

2. Cables shall be supported according to code, using “J-hooks” anchored to ceiling concrete, walls, piping supports, or structural steel beams.

3. Hooks shall be designed to maintain cable bend to larger than the minimum bend radius (typically 4x the cable diameter).

4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If cable “sag” at mid-span exceeds 6 inches, another support shall be used.

K. Cable shall never be laid directly on the ceiling grid.

L. Cables shall not be attached to existing cabling, plumbing, or steam piping, ductwork, ceiling supports, or electrical or communications conduit.

M. Manufacturers’ minimum bend radius specifications shall be observed in all instances. Use of plastic cable ties is not acceptable. Cable bundles shall be neatly dressed with use of Velcro type straps.

N. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

O. A coil of one foot in each cable shall be placed in the ceiling at the last support (e.g., J-hook) before the cables enter a fishable wall, conduit, surface raceway, or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15 feet of slack shall be left in each station cable under 250 feet in length to allow for change in the office layout without re-cabling. These “service loops” shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

P. To reduce or eliminate EMI, the following minimum separation distances from $\leq$480V power lines shall be adhered to:

1. Twelve (12) inches from power lines of $<$5-kVa

2. Eighteen (18) inches from high voltage lighting (including fluorescent)

3. Thirty-nine (39) inches from power lines of 5-kVa or greater

4. Thirty-nine (39) inches from transformers and motors

Q. All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.

3.06 INFORMATION OUTLET

A. Information outlets shall be flush mounted on wall-mounted boxes, in floor-mounted boxes, on surface raceway, or on modular furniture.

B. Any outlets to be added where these conditions are not met shall be positioned at a height matching that of existing services or as directed otherwise by the Site Coordinator and the Consultant. Nominal height (from finished floor to center line of outlet) in new installation shall be as follows:

1. Standard Voice & Data Outlet (SIO) shall match adjacent electrical outlets.

2. Wall-Mounted Telephone Outlet (Standard Voice only) shall meet ADA requirements for both front and side reach access.

C. The Contractor shall coordinate the style of the telecommunication outlets to be installed in the floor mount boxes and surface mount raceways with the Owner.

3.07 ELEVATOR INTERFACE

A. The Contractor shall furnish and install an elevator interface box outside of the elevator equipment room.

1. The Contractor shall provide an elevator telecommunications junction box located outside of the Elevator Machine Room, for interface of telecommunication cable to the elevator cab(s). This requirement complies with ANSI A17.1 code which prevents work within the Elevator Machine Room, other than specific elevator work.

2. Telecommunications J-box shall include a keyed lockable door. Additionally, the J-box shall have proper punch down blocks and data jacks suitable for terminating all cables within the J-box.

3. The Contractor shall provide any voice/data cables to this enclosure as required.

4. Electronics or cable for other systems such as security shall not be placed within this enclosure.

5. Coordinate exact location of elevator security junction box with the Elevator Contractor, Architect, and Consultant, prior to installation.

6. Cables entering the elevator telecommunications J-box and elevator equipment room shall be appropriately labeled by the Contractor, so that the Elevator Contractor can connect the appropriate wires to the elevator controllers. Wires should be individually labeled to separate them from other elevator functions and to assist the Elevator Contractor in making proper connection points.

3.08 CABLE TERMINATION

A. At the telecommunication closet, all data and voice cables shall be positioned on termination hardware in sequence of the outlet ID, starting with the lowest number.

B. Termination hardware (blocks and patch panels) positioning and layout will be reviewed and approved by the Consultant prior to construction. The review does not exempt the Contractor from meeting any of the requirements stated in this document.

C. Cable Termination – Data/Voice UTP

1. Data/voice patch panels shall be designed and installed in a fashion as to allow future station cabling to be terminated on the panel without disruption to existing connections.

2. Data patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.

3. At information outlets and data/voice patch panels, the installer shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination for data/voice cables. The cable jacket shall be removed only to the extent required to make the termination.

D. Cable Termination – Fiber Optic

1. All fibers shall be terminated using the specified connector type.

2. All terminated fibers at the telecommunications closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.

3. All couplings shall be fitted with a dust cap.

4. Fibers from multiple locations may share a common enclosure, but they shall be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure, provided they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g., “insert”).

5. Slack in each fiber shall be provided as to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of one meter (~39”) of slack shall be retained regardless of panel position relative to the potential work area.

6. If the cable is armored the Contractor shall install a plastic twist-on bushing on each end of interlocking armored fiber to protect cable from sharp edges of the armor.

3.09 TEST DATA – COPPER MEDIA

A. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test. Comma separated value (CSV) format is not acceptable.

B. The database for the completed job – including twisted-pair copper cabling links, if applicable –shall be stored and delivered on USB flash drive. This USB flash drive shall include the software tools required to view, inspect, and print any selection of test reports.

C. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the copper channel-under-test, including the NEXT worst-case margin (margin is defined as the difference between the measured value and the test limit value).

3. The overall Pass/Fail evaluation of the fiber link-under-test, including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value).

4. The date and time the test results were saved in the memory of the tester.

3.10 COPPER STATION CABLES

A. Station cabling testing shall be from the jack at the outlet in the work area to the patch panel on which the cables are terminated.

B. Testing shall be of the permanent link. Contractor shall warrant performance, however, based on channel performance and provide patch cords that meet channel performance criteria. All cabling not tested strictly in accordance with these procedures shall be retested at no cost to the Owner.

C. Testing shall be from the jack at the SIO to the patch panel on which the cables are terminated at the wiring hub.

D. Horizontal "station" cables shall be free of shorts within the pairs and shall be verified for continuity, pair validity and polarity, and wire map (conductor position on the modular jack). Any defective, split, or mispositioned pairs shall be identified and corrected.

E. Testing of the cabling systems rated at TIA Category 6/6a and above shall be performed to confirm proper functioning and performance.

F. Testing of the transmission performance of station cables (Category 6/6a) shall include the following:

1. Length
2. Attenuation
3. Pair to Pair NEXT
4. ACR
5. PSNEXT Loss
6. Return Loss
7. Pair to Pair ELFEXT Loss or ACRF
8. PSEFEXT Loss or PS-ACRF
9. Propagation Delay
10. Delay Skew
11. Return Loss

G. The maximum length of station cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables.

H. Worst case performance at 20°C, based on a horizontal cable length of 90 meters and equipment cord length of 4 meters, shall be as follows:

1. CATEGORY 6a (Permanent LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ACRF Pair to Pair (dB)	PS-ACRF (dB)
1.0	1.9	65.0	62.0	64.2	61.2

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ACRF Pair to Pair (dB)	PS-ACRF (dB)
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3
100.0	18.0	41.8	39.3	24.2	21.2
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2
300.0	32.7	34.0	31.4	14.6	11.6
400.0	38.5	29.9	27.1	12.1	9.1
500.0	43.8	26.7	23.8	10.2	7.2

I. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation method. The Contractor shall make additional tests as the Consultant deems necessary at no additional expense to the Owner or Consultant.

J. All data shall indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combination and in both directions when required by the appropriate standards.

K. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission Performance Testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify “PASS” on each cable and display the specified parameters—comparing test values with standards-based “templates” integral to the unit.

End of Section

SECTION 27 4000 – AV MULTIMEDIA GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. Successful bidder shall provide, install, configure, and provide warranty service for audiovisual systems, including displays, audio/video/graphics switching and distribution systems, integrated control systems, and other equipment as described herein.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 41 00 – Audio Visual Systems

1.03 REFERENCE

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.04 DEFINITIONS

A. HDCP: High-bandwidth Digital Content Protection or a security protocol designed to limit unauthorized use of protected content. Where applicable, HDCP compliant devices shall be utilized per design specifications. Use of HDCP compliant systems designed herein is the responsibility of the end user and compliance with Owner's Fair Use policies.

B. EDID, E-EDID: Extended Display Information Data, Enhanced-Extended Display Information Data or a remotely readable (read by a source) data file that resides in a display or specialized audiovisual device – commonly referred to as a "sink" – describing the capabilities of the sink to a connected source.

C. Configuration: the software and firmware programming that defines and creates the functionality, levels, presets, and settings of devices.

D. Configure: To define functionality, levels, presets, and settings of device(s) using software and/or firmware.

E. Programmer: Contractor personnel engaged in developing the configuration of systems.

F. DSP: Digital Signal Processing, or Digital Signal Processor.

G. AEC: Acoustic Echo Cancellation.

H. Fixed Architecture: Referring to software providing fixed processing paths with adjustable processing objects in a predetermined sequence.

I. Open Architecture: Referring to software providing infinitely variable Programmer selected processing paths with adjustable processing objects arranged in any sequence deemed appropriate by Programmer.

1.05 REFERENCE STANDARDS AND CODES

A. Giddings, G. H. Philip. *Audio Systems – Design and Installation*.
Focal Press, 1990.
Focal Press, Elsevier Inc.
30 Corporate Drive, Suite 400
Burlington, MA 01803

B. *AV Installation Handbook, Second Edition.*
InfoComm International, 2009.
11242 Waples Mill Road, Ste. 200
Fairfax, VA 22030

C. *Audiovisual Systems Performance Verification (ANSI/Infocomm 10:2013)*
InfoComm International, 2013.
11242 Waples Mill Road, Ste. 200
Fairfax, VA 22030
http://www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35975.htm

D. *Dashboard for Controls Template, Design Reference, and Integrators Guide.*
InfoComm International.
www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35324.htm

E. Copyright Act of 1976
U.S. Copyright Office
101 Independence Ave. S.E.
Washington, DC 20559
Phone: (202) 707-3000

1.06 QUALIFICATIONS

A. Primary AV Contractor shall have at least one (1) employee assigned to the project in a design or management role, and at least one (1) employee assigned to the project in an installing technician role, holding at least one of the follow certifications:

1. CTS (InfoComm International)

2. CTS-I (InfoComm International

3. CTS-D (InfoComm International)

4. EST-L2 (National Systems Contractor Association)

B. DSP and Automation/Control Systems Programmer

1. Training: Programmer shall have received manufacturer-provided and/or manufacturer-approved training in the configuration of the DSP and Automation/Control systems being provided and interfaced with.

2. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) for the DSP and Automation/Control systems hardware being provided and/or being programmed.

3. At minimum, the awarded contractor shall possess:

a. For Audinate: Dante Level 2 Certified (required), or Level 3 (preferred).

b. For QSC: Q-SYS Level 2, Q-SYS Control 201, and Q-SYS Quantum Certified

C. Control System Programmer

1. Training: Programmer shall have received manufacturer-provided and/or manufacturer-approved training in the configuration of the integrated control systems being provided.

2. Certification: Programmer shall hold the applicable manufacturer programming certification(s) or be an authorized independent programmer of the integrated control systems.

a. For AMX: AMX Certified Expert (ACE Programming Expert)

b. For Crestron: Crestron Certified Programmer

c. For Extron: Extron Control Professional

d. Or approved equal

D. Refer to subsequent sections for section specific qualification requirements.

1.07 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements

B. Structurally Mounted Elements: Including but not limited to monitors, projectors, projection screens, and loudspeakers.

C. Frequency Assignment Plans: Provide for all wireless microphones.

D. Custom Engraving: Layout and labeling/engraving of custom products including wall plates and interconnection panels. Provide engraving detail with material and finish detail.

E. Power Distribution: Plan for distribution and switching of AC and DC power to all audiovisual devices, including sequencing order of outlets and banks. Time delay to be field configured as necessary for proper system power up and down.

F. Colors: Confirm color option selections with Architect per location for items such as speakers, projectors, plates, etc.

G. Layouts of physical and virtual user controls in graphical format. This shall include:

1. Engraved buttons and overlays

2. Machine-printed adhesive labels

3. Graphical user interfaces for touch panels or web interfaces

4. Descriptive write-up of function(s) of each button for each page.

H. Copy of manufacturer configuration software, or link to manufacturer website download page for accessing configuration software.

1. Version: Submitted software shall be identical version used to create Audio DSP configuration.

I. Integrated control system review shall be done via web conference with Consultant.

J. Contractor shall make changes as requested by Consultant in pre-construction submittal review.

1.08 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.09 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

B. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

C. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

1.10 CORRECTION PERIOD

A. Length of Period: Contractor shall offer a one year correction period to Owner for this system. Contractor shall repair all equipment and cabling problems at no additional cost to Owner during the correction period.

B. Commencement: Correction period shall begin at date of Final Acceptance.

C. Final Acceptance: shall be defined as the date at which all contract work (save for a correction period) is complete, including punch list completion & verification, closeout submittals, and written verification by the Owner is obtained by the Contractor that the systems have been accepted.

D. Response: Contractor shall respond by phone within two (2) hours to calls for service or assistance from Owner during normal business hours for the duration of the correction period.

E. On-site Response: Contractor shall respond on-site within eight (8) business hours from the time of the initial phone contact in the event that the issue cannot be resolved over the phone.

F. Equipment on Loan: Contractor shall loan equipment for any broken, defective, or non-functional equipment that cannot be repaired and returned within one week. Contractor shall provide shipping, delivery, and integration at no additional cost to Owner. Equipment shall be comparable in size, speed, brightness, and relevant performance specifications, as determined by Owner.

G. Projection Lamps: Projection lamps are to be warranted by Contractor for a minimum of 90 days, or the rated life expectancy of the lamp, whichever comes first.

H. Damaged Equipment: Equipment that is damaged due to intentional misuse, abuse or negligence is not covered under this warranty; however, Contractor shall assist Owner in putting the system back in working order in the shortest possible timeframe while charging normal service rates for labor and equipment.

1.11 OWNERSHIP

A. Property Rights: Contractor assigns to Owner any and all intellectual property rights and applications made by Contractor, or its agents or employees in connection with the performance of this contract. Contractor also acknowledges and agrees that services rendered in connection with the performance of this contract shall be a “work made for hire” within the meaning of Section 201 inventions of the Copyright Law of 1976.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 PRODUCT SPECIFICATIONS

A. Provisions: Product specifications are provided in subsequent sections to Contractor for the appropriate configuration and/or provision of accessories as well as for a guide to indicate key features for possible substitutions.

B. Where wireless microphone systems are specified, Contractor shall determine optimal frequency range for final product selection and submit Manufacturer’s recommended frequency band for Owner and Consultant approval prior to ordering equipment. Contractor shall provide congruent frequency band products where like systems are specified for interoperability of components. Where three (3) or more wireless microphones are specified within the same system, Contractor shall provide and install necessary antennae distribution for optimal performance, to be submitted for Owner and Consultant approval during pre-construction phase.

C. Interconnections: Contractor shall be responsible for providing populated, grommeted, or blank cover plates for all wall and floor box openings intended for audiovisual systems.

D. Twisted Pair (TP) Category Cabling: Contractor shall use twisted pair Category cable as recommended by manufacturer of transmission equipment for optimal bandwidth and signal timing. Where cable type is not specified by manufacturer, Contractor shall use shielded twisted pair Category 6 cabling. Cable type shall be detailed in pre-construction submittals with any deviations from manufacturer recommendations expressly noted.

E. Mounts: Contractor shall fabricate mounts for projectors, monitors, loudspeakers, cameras, etc. as necessary, and shall modify standard mounts as required for optimal mounting configurations. Intended hardware shall be detailed in shop drawing submittals.

1. Custom mounting configurations shall be submitted in shop drawings for review.

2. Contractor shall provide all hardware as necessary, including flanges, Unistrut, threaded pipe, column extensions, yokes, clamps, threaded rod, aircraft cable, and any other hardware required to securely mount equipment.

3. All ceiling tile penetrations shall be neatly finished with a plate, grommet and/or escutcheon ring.

2.03 MISCELLANEOUS MATERIAL

A. Required Equipment: Contractor shall provide additional system components typically and reasonably required to make system operational even though not specifically indicated in Drawings, Appendices or Specifications including, but not limited to, cable, connectors, connecting accessories, adaptors, power supplies, power strips, rack mounting adapters and shelves, cover plates and closure panels, relays and switches, remote antenna mounts, terminal blocks, and related connector and termination hardware required by but not supplied with the equipment.

B. Blank Fill Panels: Contractor shall provide blank fill panels to cover any openings in equipment racks provided under this contract whether specified in the equipment schedules or not. Fill panels shall match finish of specified rack hardware.

C. Power Distribution Strips: Contractor shall provide power distribution strips as necessary for distributing power within equipment racks and consoles. Strips shall be UL listed, be securely mountable, and appropriate for professional installation.

D. Wall Openings: Contractor shall provide blank faceplates to cover any unused openings within the project area. Faceplate type and finish to match electrical outlets in the project.

E. Input Cables: Contractor shall provide all interconnection cables shown on the project drawings, as well as end-user input cables at all locations where laptops and other user devices are intended to be connected.

F. Keys: Keys for like equipment shall be identical.

G. Wireless Transceivers: Where wireless transceivers are specified (including, but not limited to wireless microphones, wireless assistive listening devices, etc.) Contractor shall verify frequency band range of existing Owner wireless systems. Contractor shall provide wireless transceiver system(s) compatible with existing equipment for interoperability.

H. Cable Sleeving:

1. Shall be black expandable sleeving, with ends neatly turned under 2”, held in place either by nylon tie-wrap, or heat-shrink tubing. Tie wraps, if used, shall not deform cables within the umbilical. Cables requiring sleeving include:

a. Exposed cabling outside of wire management in console furniture.

b. Cable umbilicals connecting to or from wall, floor, or ceiling plates consisting of more than one wire.

2. Contractor shall coordinate as necessary so that all low-voltage cabling (including Ethernet) are included in a single umbilical

2.04 POWER DEVICES

A. Refer to Section 27 00 00 for additional requirements.

B. All large venue audio amplifiers shall be on sequenced outlets.

2.05 FIRE STOPPING MATERIALS

A. Refer to Section 27 00 00 for additional requirements.

PART 3 - EXECUTION

3.01 EQUIPMENT

A. As required by Section 27 00 00.

1. Safety: Contractor shall use proper structural installation techniques and maintain a minimum 5:1 safety margin.

2. Custom Mounting Finish: Custom mounting hardware shall be painted by Contractor to match either color of wall, ceiling or equipment, at Consultant's discretion.

3.02 INTERCONNECTION

A. As required by Section 27 00 00.

1. Interpretation: Contractor shall make system interconnections as indicated on Drawings and specified herein. Contractor shall interpret Drawings using an understanding of the equipment and general system topology (both existing and future/specified). Contractor shall provide power and control lines to and from power supplies, remotely controlled equipment and other devices even though not explicitly indicated on Drawings or listed in equipment tables.

2. Additional: Contractor shall be responsible for associated equipment signals not specifically documented in provided drawings. These include synchronizing signals, transmitting and receiving antennas, and LAN connections to equipment provided and/or installed by Contractor.

3. Mass Notifications: Contractor shall ensure that audio systems are appropriately managed by emergency notifications so that emergency notifications are not impeded by the audio system.

3.03 CABLE MANAGEMENT

A. As required by Section 27 00 00.

1. Above Ceiling: Cabling located above ceilings shall be tied off to and supported by ceiling supports or other structures at a minimum of eighteen (18) inches above the ceiling.

2. Not on Ceiling: Cabling shall not lie on the ceiling.

3. Wall Cabling: Cables installed in a horizontal fashion along wall surfaces shall be installed in surface raceway approved by Owner and Consultant.

4. Floor Cabling: Cabling placed at floor level such as microphones shall be installed on the floor in the shortest possible route to the nearest wall considering traffic patterns and in an enclosure designed for that use and offering protection from foot traffic.

5. Desk Cabling: Where a cable is installed inside desk furniture, a means of protecting the cables and holding cabling to a fixed surface shall be installed.

6. Grommets: Holes in horizontal furniture surfaces for cable pass-through shall be provided with appropriate sized grommet. Grommet shall be black unless otherwise specified or required.

7. Stub-ups: Where conduit is stubbed-up through the floor and exposed, Contractor shall wrap cables with black expandable sleeving and secure at least three (3) inches below level of conduit top.

    a. Where conduit is stubbed-up through floor and concealed within furniture, Contractor shall install tether comprised of aircraft cabling to limit the distance furniture may be moved away from stubbed-up conduit. Cabling service loop exiting stubbed-up conduit and entering furniture shall be longer than the corresponding tether, providing protection against movement of furniture that would otherwise damage installed cabling.

8. Umbilicals: Exposed cable umbilicals, such as those between instructional furniture and a floor- or wall-mounted plate, shall be covered in black expandable sleeving, with neatly finished ends (heat-shrink or Consultant-approved method).

3.04 CONNECTOR TERMINATION

A. As required by Section 27 00 00.

1. Video Connectors: Video connectors (BNC, RCA, and F) shall be terminated using a crimp tool or dies designed specifically for the connectors being applied.

2. XLR Connectors: Terminate XLR type connectors wired pin 2 high, pin 3 low, and pin 1 shield.

3. UTP: UTP cable shall be terminated with appropriate crimps tools or tools specified by manufacturer.

3.05 GROUNDING

A. Audiovisual equipment racks shall be grounded to the telecommunication grounding system with a minimum 6 AWG grounding cable. Refer to Section 27 00 00 for additional grounding requirements.

3.06 TESTING & INSPECTION

A. General Information: As required by Section 27 00 00.

B. Notification: Prior to start of testing, provide a list to Consultant of test equipment make, model numbers and calibration dates that will be used.

C. Testing: Contractor shall perform complete testing on system before inspection. Selected systems may be retested during inspection at Owner’s discretion.

D. Display/Output checks: Contractor shall verify that visual and audio outputs from the system are high-quality and without noticeable distortion or feedback at normal operating levels.

E. Wiring and Labeling: Contractor shall check all inputs and outputs for correct wiring and labeling.

F. Loudspeakers: Contractor shall measure the impedance of each speaker line leaving the equipment racks. For full range devices, use a frequency of 1000 Hz. For band limited devices, use a frequency appropriate for the operating range of the transducer. When documenting results, Contractor shall include the calculated impedance based on number of units on a line and the size and distance of the run. Contractor shall correct any field readings that differ more than 20% from the calculated impedance. Contractor shall use an electronic polarity checker to test each reinforcement speaker. Speakers shall have the same relative polarity.

3.07 COMPUTER GRAPHICS

A. Computer graphics shall be crisp and focused with respect to color alignment. If color alignment is not registered properly, Contractor shall identify source of problem and correct. EDID and other auto-registration features shall be set within AV equipment where required for optimal system performance.

3.08 TRAINING

A. General Information: As required by Section 27 00 00 and following section(s).

B. Coordination and Personnel: Training shall be coordinated with Owner's schedule, and Contractor personnel who provide training are subject to Owner's approval.

3.09 PROJECT CLOSEOUT

A. Completion: System shall be considered complete when all of the following has occurred:

1. Testing has been completed to the satisfaction of Owner and Consultant.
2. Punch-listed items have been addressed to the satisfaction of Owner.
3. As-built drawings and system documentation has been turned over to Owner and Consultant.
4. Complete operational training has been conducted with Owner's staff.
5. System Commissioning Process has been completed.

B. Acceptance: Contractor shall secure written Acceptance of systems in the form of authorized Owner signature on Acceptance Document. This shall constitute the Date of Acceptance.

End of Section

SECTION 27 4100 – AUDIO VISUAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. Provide audio visual systems as well as training and warranty services for those systems as described herein.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 40 00 – AV/Multimedia General Requirements

1.03 REFERENCE

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 and 27 40 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.04 CORRECTION PERIOD

A. General Information: Products shall be covered by Contractor correction period as required by Sections 27 00 00 and 27 40 00.

B. Correction Period: Contractor's obligation for correction period shall not abrogate manufacturers' warranty periods.

C. Commencement: Correction Period begins on Date of Acceptance.

1.05 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Qualifications

1. Provide certificates for employees working on this project that show they meet the necessary qualifications described in 27 40 00 Part 1, including AVIXA CTS/CTS-I/CTS-D, control system programming certifications, digital signal processor certifications, Dante certifications, and any other certifications necessary to purchase and install the specified products.

C. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

2. Provide a separate schedule of materials for each system or room type.

D. Color Selection List

1. Provide a list of all audiovisual equipment that will be visible to staff and visitors. Include a simplified description of the equipment that a non-technical person (i.e. Architect) can understand. Examples of such items include but are not limited to speakers, projectors, projection screen cases, cameras, antennas, control panels, input plates, microphones, ceiling enclosures, wall enclosures, specialty furniture, monitor arms, cable cubbies or grommets, rigging, mounts, and wireless access points.

2. For each item on the list, include all available color/finish options, with a checkbox next to each option for the Architect or Owner to select.

3. Provide a separate list for each room type. The same product may require a different color in different rooms to match the aesthetics of the space.

4. The AV Contractor must receive confirmation of color selection from the Architect or Owner in writing before ordering any materials that will be visible after installation. If the Contractor fails to complete this step, the Owner reserves the right to object to an installed device’s color and require that the Contractor replace it at no cost to the Owner.

E. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

F. Shop Drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-

construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

    a. Floor Plans: Include device/equipment locations, cable routes, maximum cable distance calculations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

    b. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

    c. Equipment Rack/Cabinet & Wall Equipment Elevations: Include placement of all rack/cabinet or wall-mounted equipment, drawn to scale.

    d. Structurally Mounted Elements: Include a plan view of placement and a detail of the structural mounting techniques to be used.

    e. Furniture: For all Contractor-provided furniture, include dimensional drawings, cable management, and finishes with samples for Owner approval.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Network Device Schedule

1. Provide a schedule of AV devices requiring IP addresses from the Owner. The schedule shall include columns for relevant information such as Manufacturer, Model, MAC Address, Serial Number, Description, Location, etc. The Contractor shall provide additional information when required by the Owner to assist them in assigning IP addresses.

B. Touch Panel Layouts

1. Provide a submittal with proposed touch panel page layouts. Include notes that narrate the functionality of each button.

2. Include separate layouts for each differing room type.

3. The Consultant shall review this submittal first and may require resubmittals to address concerns. Once the layouts are acceptable to the Consultant, the Contractor shall meet with the Owner and Consultant and present the touch panels for the Owner’s consideration.

4. Approval of the touch panel layouts does not exempt the Contractor from making additional changes once the system is installed. The Owner reserves the right to request additional changes to the system programming and graphical user interface (GUI) for three (3) months after the initial system training, and the Contractor is required to make these changes at no additional cost to the Owner.

1.08 OWNERSHIP

A. General: Upon completion of the project, all programming and configuration of control hardware, touch panels, and other devices shall be the property of the Owner.

B. Property Rights: Contractor assigns to Owner any and all intellectual property rights and applications made by Contractor, or its agents or employees in connection with the performance of this contract. Contractor also acknowledges and agrees that services rendered in connection with the performance of this contract shall be a "work made for hire" within the meaning of Section 201 inventions of the Copyright Law of 1976.

C. No Passwords: Contractor shall not use any passwords to prevent access to code files except as specified herein.

1.09 TURN-OVER CABLES

A. Contractor shall provide an end-user input cable for every wall plate connection or other end-user input location.

B. Turn-over cables shall match the quality and requirements of the main cable run for that signal type; refer to 27 40 00.

C. Turn-over cables shall be 10-feet in length except where noted otherwise or where required for system functionality.

1.10 MANUFACTURER COORDINATION

A. Contractor shall contact the manufacturer(s) to obtain master quote information if available. Master quotes often contain additional products that may not explicitly appear in the specifications.

1.11 SYSTEM DESCRIPTIONS

A. General

1. This specification is intended to describe the general system types/locations and components, not every connection or room. The technology drawings more fully describe these systems and must be reviewed thoroughly in conjunction with the specification.

2. The technology floor plans indicate AV device locations, including input plates, speakers, projectors, flat panel displays, wall controllers, AV cabinets, etc.

3. The technology schematics (located on the "Technology Details" drawing sheets) indicate AV components in each system type and how they are connected. The components are described generally (ex: "AMPLIFIER") with the specified model indicated below. Some device model numbers are not indicated in these written AV specifications and must be found on the technology drawing schematics located in the detail sheets. The schematics also indicate specific installation and functional requirements not shown elsewhere.

4. The loudspeaker schedule (located on the "Technology Details" drawing sheets) indicates speaker models and other requirements. It specifies which model speaker shall be provided at each location type by using numbered identifiers that appear on the symbols on the floorplans (ex: "S1" for speaker type 1).

5. The display schedule (located on the "Technology Details" drawing sheets) indicates the anticipated display size for a given location, as well as the intended use and a reference to the associated AV schematic drawing. For example, "FP1" will be defined here to tell you the purpose, size, height, and associated AV system detail that applies anywhere you see an "FP1" symbol on the floor plans. Be aware that a room's name on the

architectural floor plans may not match the system name for the space. Use the flat panel numbers to determine what system is required.

6. Each system description includes a list of anticipated equipment. This list generally describes the type and quantity of major components. For detailed specification requirements regarding these components, refer to Part 2 as well as the AV schematic line drawings. Interconnecting cables are generally not listed as “major components” but are required and assumed to be included.

B. Existing Classroom – Classroom Audio Upgrade Only

1. Specific existing classrooms will receive a new Classroom audio system run through an Audio Enhancements Classroom audio/paging system and consist of an Amplifier/Receiver unit, wireless wearable teacher microphone, and between 2-6 ceiling mounted speakers.

2. General System Components:

a. Audio Enhancement Classroom Audio System

C. Classroom AV System w/ Classroom Audio

1. Standard Classroom AV systems will consist of a wall mounted flat panel display at the front of the classroom. System inputs shall include a wall plate including HDMI and USB-C connections located at the front of the room and an Apple TV mounted on the front wall next to the display. Classroom audio will be run through an Audio Enhancements Classroom audio/paging system and consist of an Amplifier/Receiver unit, wireless wearable teacher microphone, and between 2-6 ceiling mounted speakers.

2. General System Components:

a. Flat Panel Display

b. AV Extender System

c. Apple TV

d. Audio Enhancement Classroom Audio System

D. Classroom AV System w/o Classroom Audio

1. Standard Classroom AV systems will consist of a wall mounted flat panel display at the front of the classroom. System inputs shall include a wall plate including HDMI and USB-C connections located at the front of the room and an Apple TV mounted on the front wall next to the display.

2. General System Components:

a. Flat Panel Display

b. AV Extender System

c. Apple TV

E. Classroom AV System – Multiple Displays

1. Specific Classrooms will receive multiple displays. These AV systems will consist of wall mounted flat panel displays at the various locations in the classroom. System inputs shall include a wall plate including HDMI and USB-C connections located at each display

location and an Apple TV mounted on the front wall next to the primary display. Inputs located at the primary display will be able to be routed to the other displays in the room. Classroom audio will be run through an Audio Enhancements Classroom audio/paging system and consist of an Amplifier/Receiver unit, wireless wearable teacher microphone, and between 2-8 ceiling mounted speakers.

2. General System Components:

    a. Flat Panel Display

    b. AV Extender System

    c. HDMI Signal Distribution

    d. Apple TV

    e. Audio Enhancement Classroom Audio System

F. Signage Displays

1. Signage displays will be located throughout the building. Each of these locations will consist of a flat panel display and Apple TV mounted behind the display.

2. General System Components:

    a. Flat Panel Display

    b. Apple TV

G. Welcome Area Display

1. The Welcome Area near the main entrance will receive a large flat panel display and Apple TV mounted behind the display. Audio will be handled through a sound bar mounted below the display and custom ordered to match the width of the display.

2. General System Components:

    a. Flat Panel Display

    b. Apple TV

    c. Audio Amplifier

    d. Sound Bar

H. Security Office

1. The Security Office will receive a flat panel display with an HDMI input plate mounted below for connection to a Owner provided PC running the Owners video surveillance software.

2. General System Components:

    a. Flat Panel Display

    b. HDMI Wall Plate

I. Medium Conference Room

1. These conference rooms will consist of a flat panel display mounted at the front of the room. System inputs will include an Apple TV and HDMI connection at the table. A UC conferencing bar will be mounted under the display and can be connected to a laptop at the table to provide the user with speaker, microphone, and camera peripherals to accommodate UC meetings hosted by the Owner's laptop.

2. General System Components:

    a. Flat Panel Display

    b. Apple TV

    c. UC Conferencing Bar

    d. AV Extender System

    e. USB Extender System

J. Large Conference Room

1. These conference rooms will consist of a flat panel display mounted at the front of the room. System inputs will include an Apple TV and HDMI connection at the table. A PTZ camera will be mounted under the display and speakers will be mounted to either side of the display. Ceiling microphones will be installed for audio pick up. Users can connect a laptop at the table via USB to the system to receiver speaker, microphone, and camera peripherals to accommodate UC meetings hosted by the Owner's laptop.

2. General System Components:

    a. Flat Panel Display

    b. Apple TV

    c. UC Conferencing System

    d. AV Extender System

    e. USB Extender System

K. Recording / Huddle Room

1. These rooms will consist of a flat panel display mounted at the front of the room. System inputs will include an Apple TV and HDMI connection at the table. A UC conferencing bar will be mounted above the display and can be connected to a laptop at the table to provide the user with speaker, microphone, and camera peripherals to accommodate UC meetings hosted by the Owner's laptop or recording lessons.

2. General System Components:

    a. Flat Panel Display

    b. Apple TV

    c. UC Conferencing Bar

L. Commons Area

1. This space will be used for all hands meetings. It will consist of a ceiling mounted projector and screen as the primary display. System inputs will include an Apple TV located in the AV rack and an HDMI input and Bluetooth audio plate located at the wall

box at the front of the room. Additionally, a wireless microphone system, amplifier, assisted listening system, and pendant speakers will complete the audio system. System controls will be handled via a touch panel located in the wall box in the front of the room.

2. General System Components:

    a. Laser Projector

    b. Motorized Projection Screen

    c. Apple TV

    d. AV Over IP Devices

    e. Wireless Microphone System

    f. Audio Amplifier

    g. Assisted Listening System

    h. Pendant Speakers

    i. Digital Signal Processor

    j. Control System Processor

    k. Touch Panel

M. Gym

1. An audio system will be provided in the Gym. System inputs will include a Bluetooth audio plate and AUX audio wall plate located in a wall box at the front of the room. Additionally, a wireless microphone system, multimedia player, amplifier, assisted listening system, and wall mounted speakers will complete the audio system. System controls will be handled via a touch panel located in the wall box in the front of the room.

2. General System Components:

    a. Wireless Microphone System

    b. Audio Amplifier

    c. Assisted Listening System

    d. Wall Speakers

    e. Digital Signal Processor

    f. Control System Processor

    g. Touch Panel

N. Weight Room

1. An audio system will be provided in the Weight Room. A Bluetooth wall plate will be provided as an audio input into the system. An amplifier and ceiling speakers will be provided to play audio throughout the space.

2. General System Components:

a. Audio Amplifier

b. Ceiling Speakers

c. Bluetooth Wall Plate

PART 2 - PRODUCTS

2.01 ADDITIONAL SPECIFIED PRODUCTS

A. Many AV products are specified on the technology drawings and not necessarily listed in this specification. AV products shown in the drawings shall be considered part of this specification regardless of whether they are also listed below.

B. If a specific product manufacturer and/or model is indicated on the drawings and other manufacturers are listed in this specification, the product shown on the drawings shall be the basis of design. Equal products by the other listed manufacturers may be considered via the substitution process outlined in 27 00 00.

C. AV products specified in the drawings typically appear on the AV detail sheets, either in a schematic line drawing, a loose equipment list, or a schedule (ex: speakers, displays, etc.).

D. Not all AV products appear on the drawings. Products listed in this specification but not shown on the drawings are still required as part of a comprehensive AV bid package.

2.02 ASSISTIVE LISTENING SYSTEMS

A. Assistive listening systems shall include stationary transmitter (and antenna distribution if needed) with receivers, earphones, neckloops, and signage.

B. Provide all components necessary to meet ADA / IBC and local code requirements for the space. Quantity of receivers, earphones, and neckloops shall be calculated to meet ADA / IBC formulas.

C. In addition to ADA-required components, provide locking carrying cases with charging bases and rechargeable batteries to match the number of receivers.

D. Technology:

1. IR – Provide infrared system in smaller spaces where information being shared is secret or confidential and in buildings where there are many such systems and not enough RF spectrum for the channel count.

2. RF – Provide radio frequency system (72 MHz or 216 MHz) in locations where a large coverage area is needed, and information being shared is not expected to be secret or confidential.

3. Wi-Fi – Provide a Wi-Fi/network system as a secondary solution in all spaces with assistive listening

4. Loop – Provide an underfloor hearing loop where required by local code and/or indicated in the system description or design details

E. Manufacturers: Listen Technologies, Williams Sound, or equal

2.03 AUDIO AMPLIFIERS

A. Amplifiers shall be sized to match the speaker manufacturer's recommended amplifier power plus 20% additional headroom

B. Refer to technology drawing details for specific product information.

C. Manufacturers:

1. Biamp
2. Crown
3. Lab Gruppen
4. QSC

2.04 AV NETWORK SWITCHES

A. Provide network switches for AV systems as necessary.

B. Switches shall be sized to match the number of connections and PoE/PoE+ load.

C. For AV systems where the AV manufacturer publishes a list of recommended or approved switches, the network switches must be on this list. For AV systems where the AV manufacturer does not publish a list, the network switches must meet the minimum specifications required by the AV equipment and recommended by the manufacturers.

D. Manufacturer: Netgear M4250 Series or equivalent

2.05 AV-OVER-IP SYSTEM

A. Provide models as required by location/function

B. Manufacturers:

1. Crestron DM NVX Series
2. Extron NAV Series
3. Visionary Solutions
4. QSYS NV Series

2.06 AV SIGNAL EXTENDERS

A. Point-to-point video extension of audiovisual signals with operating distance limitations (ex. HDMI / USB) shall be provided wherever necessary or noted in the system descriptions and/or on the plans.

B. Manufacturers:

1. Crestron
2. Extron
3. Approved Equal

2.07 BLUETOOTH EXTENDER PLATES

A. Single-gang, Decora style in-wall Bluetooth audio interface

B. One button pairing/connect with LED indicator

C. Serial control protocol for integration with control system

D. Compatible with smartphones, Apple iPads, and Android tablets

E. Manufacturer: Crestron DM-NAX-BTIO-1G or approved equal

2.08 CABLE

A. Cable shall be provided and installed as detailed herein. Cable installed that does not conform to these standards or that has not been given prior approval by Consultant shall be removed by Contractor and replaced at Contractor's sole expense.

B. Plenum: Plenum-rated cables shall be used where required by code or by best practices. All cables run beneath raised floor shall be plenum-rated.

C. High-Definition Digital Video (HDMI)

1. Due to HDMI distance limitations, anywhere the cable distance exceeds 20 feet, an acceptable solution shall include some form of extension. Extension shall be via UTP/XTP extenders. Contractor shall provide extenders where cables exceed 20 feet regardless of whether they are explicitly shown or specified. At locations where the end-to-end cable distance is 20 feet or less, commercial-grade passive HDMI cables may be used. Provide a cable channel that is reliable and functions with all source devices the Owner may use.

2. Acceptable solution shall support HDMI 2.0a and 4K@60Hz 4:4:4 at minimum.

3. Acceptable solution shall be manufactured by a Pro AV manufacturer with 5+ years in the AV industry and an existing install base in the region.

4. Manufacturers:

a. Atlona

b. Broadata

c. Crestron

d. Extron

e. Liberty AV

D. USB

1. Due to USB distance limitations, anywhere the cable is routed within the wall or above the ceiling, an acceptable solution shall include some form of extension. Extension shall be via UTP/XTP extenders. Contractor shall provide extenders where cables route through walls or ceilings regardless of whether they are explicitly shown or specified.

2. Acceptable solution shall support at a minimum USB 2.0 except where noted otherwise.

3. Acceptable solution shall be manufactured by a Pro AV manufacturer with 5+ years in the AV industry and an existing install base in the region.

4. Manufacturers:

    a. Atlona

    b. Broadata

    c. Crestron

    d. Extron

    e. Liberty AV

E. Installed Video: Video signal coaxial cables shall have #18 solid copper center conductor, gas-injected high density Polyethylene or Fluorinated Ethylene Propylene insulation, copper braid shield of at least 95% coverage and 100% dual-sided foil and black PVC jacket unless color is otherwise noted. Cable shall be designed as a low loss serial digital video cable. Belden 1694A, WestPenn 6350, Canare L-5CFB, Liberty 18-CMR-SD, or equal. Plenum cable, Belden 1695A, WestPenn 256350, Liberty 18-CMP-VID-COAX, or equal.

F. Flexible Video: Short video cables that are intended to be moved or adjusted on a regular, frequent basis may be constructed of a stranded bare copper center conductor RG-59/equivalent cable with >94% copper braid shield and polyethylene dielectric. Canare LV-61S, Belden 1505A, WestPenn 819, or equal. Plenum cable, Belden 1506A, WestPenn 25819, or equal.

G. High Resolution RGBHV Graphics/Video: Cable type and size shall be selected to provide a minimum of 250 MHz bandwidth (-3dB) at over the length of each RGBHV signal path from source to display, including losses and gains through cable loss, signal processing, switching and distribution equipment. Manufacturer shall designate cable as suitable for high-resolution use. Extron MHR-5, Liberty RGB5C-25-CM or equal. Plenum cable, Extron MHR-5P, Liberty RGB5C-25-CMP, or equal.

H. Installed Line Level and Microphone (single line): Audio signal cable shall have twisted pair #22 stranded tinned copper conductors, polyethylene conductor insulation, aluminum-polyester foil shield, #24 stranded tinned copper drain wire and chrome PVC jacket. Belden 8761, West Penn 291, Canare L-2T2S, Liberty 24-2P-STAR, or equal. Plenum cable, Belden 88761 or equal.

I. Portable Microphone, Enclosure and Breakout Line Level Audio: Cable shall have 4 conductors per channel arranged in star quad double-balanced pairing, #24 stranded conductors of at least 40 tinned annealed copper wires, 100% coverage wrap shield, tinned copper braid shield of approximately 50% coverage, uniformly round form and black PVC jacket. Canare L-4E6S, Belden 8723, WestPenn 355, or equal. Plenum Cable, Belden 88723, Liberty 24-4P-PLCSH-WHT, or equal.

J. Broadband Video Antenna Cable: For runs shorter than 15', RG-59. For runs 15'-50', RG-6.

K. Wireless Microphone Antenna Extension Cable: 50-Ohm coaxial cable, or as directed by microphone manufacturer.

L. Loudspeaker Wire: 14 AWG minimum.

M. Subwoofer Wire: 10 AWG minimum.

N. UTP Cable: Shall be consistent with specific recommendations by hardware manufacturer of transmission equipment. Where no clear recommendation is made, the cable shall at a minimum meet the Category 6 performance requirements outlined in 27 15 00.

O. Control: Shall be as recommended by equipment manufacturer, with the appropriate number of conductors for the application.

P. Cable Construction: Contractor shall fabricate interconnecting cables using products defined in this section unless equipment manufacturer-provided cable is of a specialized or proprietary nature. Pre-manufactured cables are subject to prior approval by Consultant.

Q. Labels: Labels shall include a white paper or vinyl slip with typed or machine printed designations, secured in place with a wider section of clear heat shrink tubing or integral clear adhesive-backed plastic.

R. Terminations: Provide specialized terminating hardware as required.

S. Schedule: Contractor shall submit schedule prior to installation for Consultant review indicating cable types that will be used on the project

2.09 CLASSROOM VOICELIFT SYSTEM

A. The voicelift system shall consist of a wireless teacher microphone, wireless student microphone, a receiver/amplifier, speakers, and accessories as necessary to meet the functionality described. The voicelift system shall be compatible with the overall campus paging system, capable of receiving audio from the headend, refer to 27 5113 for details.

B. The Contractor shall install an audio cable from the Owner-furnished flat panel display to the receiver/amplifier and configure the system to amplify the multimedia audio coming from the display. The Contractor shall confirm the connector and signal type from the display and provide any necessary adapters to convert from a standard audio output (e.g. S/PDIF, 3.5mm, etc.)

C. Manufacturer: Audio Enhancement Optimum System

1. Receiver/Amplifier: MS-700

2. Microphones: XD Teacher Box with XD Teacher Mic, XD Handheld Mic

3. Classroom cut-in ceiling speaker: Audio Enhancement CS-12

4. Classroom pendant speaker: Audio Enhancement SP-1086

2.10 CONFERENCING SYSTEM

A. All-in-one soundbar

1. Conferencing soundbar with speaker, camera, and microphone in a single enclosure and one USB connector.

2. Single USB 3.0 interface

3. Built-in 180-degree far field microphone array

4. Built-in intelligent 1080p video camera with digital autozoom and autoframing

5. High powered 2-way stereo speakers

6. Manufacturer:
    a. Crestron
    b. Logitech
    c. Biamp
    d. Bose
    e. or approved equal

B. Conference room kit
    1. Manufacturer:
        a. Logitech Rally Plus kit solutions

2.11 CONNECTORS

A. Connectors shall be provided and installed as detailed herein. Connectors installed that do not conform to these standards or that have not been given prior approval by Consultant shall be removed by Contractor and replaced at Contractor's sole expense.

B. HDMI (Video/Audio/Control): Cables to be factory-terminated with molded strain relief.

C. BNC (Video): Video signal BNC connectors shall be 3-piece crimp-on type with insertion barrel and ferrule, and gold flashed crimp-on center pin. Barrel shall provide full circumferential contact with the braid. Fittings shall be sized to fit the cable. Canare BCP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

D. RCA (Video): Video signal RCA connectors shall be 3-piece crimp-on type with gold flashed center pin, Canare RCAP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

E. F (Video): Video signal F connectors shall be 3-piece crimp-on type with gold flashed crimp-on center pin. Canare FP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

F. BNC (RGBHV Graphics): Graphics signal BNC connector shall be crimp-on type with insertion barrel and ferrule, and gold flashed crimp-on center pin. Barrel shall provide full circumferential contact with the braid. Fittings shall be sized to fit the cable. BNC manufacturer, model and tools as recommended by the manufacturer of the RGBHV/graphics cable.

G. XLR: Strain relief shall be sized to fit the cable. Connector shell shall be isolated from all contacts. Neutrik CA-NC series or equal.

H. Mini-XLR: Strain relief shall be sized to fit the cable. Connector shell shall be isolated from all contacts. Switchcraft or equivalent.

I. Phono (RCA): Phono/RCA connectors shall have gold contact and solid center pin with metal strain relief. Canare F-10 or Canare F-09 or equal.

J. Phone (1/4 inch): Reinforced one-piece body shall have brass bar running length of handle. Canare F-15 (TS) or Canare F-16 (TRS) or equal.

K. Mini (1/8 inch): Shall be Canare F-11 (TS) or Canare F-12 (TRS) or equal.

L. RJ45: RJ45 jacks that are field-terminated shall be punch-down type. All flexible connectivity to AV devices shall be factory-molded patch cables. Where a field-terminated plug is required by manufacturer recommendations, Contractor shall use appropriate connector type to the type of cable used (solid vs. stranded).

M. Shielded cable to be terminated with shielded connectors or as required by manufacturer recommendations.

N. DM, DM8G+: Shall be Crestron shielded RJ-45 and fiber connectors, as recommended by manufacturer of DM or DM8G+ system.

O. Schedule: Contractor shall submit schedule prior to installation for Consultant review indicating connectors that will be used on the project.

2.12 CONTROL SYSTEMS

A. Control system processor with ability to control all major system components and functions within a given room, including items such as: flat panel displays, media players, projectors, projection screens, presentation switcher, digital mixer, digital signal processor (DSP), power sequencers, etc.

B. Control system may be built into a presentation switcher, DSP, or standalone

C. Each control system shall include a control interface. In large venue or complex spaces, this shall be a touch panel controller – 7” or 10” minimum diagonal size depending on requirements. In smaller spaces and simpler systems, this could be a smaller touch panel, keypad, or button panel.

D. Control systems shall be network manageable. Contractor shall set up manufacturer’s network interface for Owner to use.

E. Manufacturers: Crestron, Extron, QSC

2.13 DIGITAL SIGNAL PROCESSOR

A. Minimum 4 input, 4 output audio DSP. Provide larger model and/or additional expansion I/O modules as necessary to support the number of connections in a given system.

B. Supports Acoustic Echo Cancellation on microphone inputs

C. RS-232 and/or Ethernet control to interface with AV control system.

D. Dante support where applicable

E. Manufacturers: Biamp, Extron, QSC, or Crestron

2.14 EQUIPMENT RACKS

A. Sized to fit all system equipment with space for airflow and future expansion

B. Casework/millwork locations

1. Sized to fit all system equipment with space for airflow and future expansion

2. Coordinated to fit inside of casework; refer to architectural plans

    a. Fan kit with thermostatic fan control

    b. Coordinate active cooling and ventilation with millwork contractor

    c. Ventilation shall include passive air intake at the bottom and exhaust at the top

3. Manufacturer: Middle Atlantic SRSR Series

C. Fixed wall locations

1. Provide with:

    a. 1 RU vented blank panels between all major components (e.g. amplifiers) and equipment groupings (e.g. wireless receivers, media players, etc.)

    b. 4 RU rack drawer for housing microphones and cables

    c. Locking vented front door

    d. Quiet fan kit with thermostatic fan control

2. Manufacturers: Middle Atlantic SR-Series or equal

2.15 INTERFACE PANELS

A. Finish: Interface plates and connector panels shall be as indicated on Drawings and as specified herein. Finish on custom wall interface plates shall match that of electrical and other work and shall be coordinated with Consultant prior to ordering. Connector panels in equipment racks shall match finish of rack frame and specified/provided blank panels unless called out otherwise in equipment schedules.

B. Floor Boxes: Floor box plates shall be provided wherever connectivity through a floor box is indicated on drawings.

C. Labels: Interface plates and connector panels shall be engraved to show connector functionality. Engravings shall be finished with a contrasting color to plate finish.

D. Connector Placement: Verify connector layout detail for custom panels.

E. Box Mounts: Wall and floor interface plates shall mount to appropriate electrical conduit boxes unless indicated otherwise.

F. Cut-ins: Where no box is provided, Contractor shall cut in appropriate opening for plate, and provide appropriately sized mud-ring/caddy to securely attach plate to wall.

G. Rack Blank Panels: Contractor shall provide all blank rack panels necessary to fill opening in the front of AV equipment racks, whether specified in the equipment schedules or not.

2.16 POWER SOLUTIONS

A. Large Systems

1. Rack mount main sequencer with additional modules as necessary. Provide power sequencers at all large venue AV racks or any rack with an audio amplifier greater than 50W. Does not apply to systems where the amplifier is intended to remain on; ex: Energy Star amplifiers in ceiling enclosures.

2. Power output shall match recommended input power for system equipment. Main sequencer shall have 120V/20A output. Additional modules with 120V/30A or 220V/20A output may be required for certain amplifiers.

3. Provide with surge protection and remote switch

4. Minimum of six rear outlets and three sequenced groups of outlets

5. RS-232 and/or Ethernet control to interface with AV control system

6. Manufacturers: Furman, Middle Atlantic, Surge-X

B. Small Systems

1. Provide a rack mount 1 RU horizontal power strip with surge suppression at each equipment rack

2. Manufacturers: Furman, Middle Atlantic, Surge-X

2.17 PRESENTATION SWITCHERS / DISTRIBUTION AMPLIFIERS

A. Mixture of HDMI inputs and HDMI outputs. Quantity of each based upon needs of space.

B. Supports signal resolutions up to 4K/60 with 4:4:4 color sampling

C. Audio de-embedding to route audio from HDMI sources into sound system

D. May include built-in control processor

E. Manufacturer: Crestron, Extron, or approved equal

2.18 PROJECTION SYSTEMS

A. Projectors

1. Laser light source

2. WUXGA (1920x1200) resolution minimum

3. Minimum of 100 fL (footLambert) image brightness on associated screen

4. Model with optional lenses for range of throw distances when necessary

5. Manufacturers: Epson, Panasonic, Sony

B. Projection Screens

1. Widescreen aspect ratio, 16:10

2. Recessed in ceiling whenever feasible

3. Screen surface shall match installation conditions. For front projection, provide HD-compatible screen with 0.9, 1.1, or 1.3 screen gain depending on ambient light. For rear projection, provide screen surface capable of both front and rear projection. Minimum of 0.9 gain and 65-degree half angle.

4. Screen sizes shall be sized to provide clear visibility to the furthest viewer. Follow AVIXA sizing requirements.

5. The screen size and black drop will be calculated so that the bottom of the image area is approximately 48” above finished floor, and never lower than 42” AFF.
6. Refer to technology drawings for screen sizes and types per location.
7. Contractor shall coordinate exact mounting details with Architect
8. Manufacturer
    a. Draper
    b. Da-Lite

C. Projector Mounts

1. Mounts should be appropriate for the projector size and installation conditions
2. Provide with protective cage when mounted in gymnasiums and other spaces where there may be projectiles or other potential damage.
3. Manufacturer: Chief
    a. Ceiling Mount – Chief RPMAU Series
    b. Ultra-short throw – provide model recommended by projector manufacturer

2.19 SPEAKERS

A. Refer to speaker schedule in technology drawings

B. Local sound reinforcement

1. Ceiling speakers
    a. 2-way 8” in-ceiling speaker with 60W 70/100V transformer and 150W program power at 8 ohms
    b. Manufacturers:
        i. Community D8
        ii. Electro-Voice EVID-C8.2
        iii. QSC AD-C821
2. Pendant
    a. Manufacturers:
        i. Electro-Voice EVID-P6.2 or equivalent

2.20 WALL PLATES

A. All faceplates and plate devices shall be coordinated with the architect to ensure that the finish is consistent with the aesthetic of the space

B. All device plates shall support the same signal transmission requirements as the interconnecting cables. Refer to the “Cables” sections for more information.

C. Passive HDMI plates shall include a pigtail on the back to facilitate appropriate bend radius and smooth transition into conduit.

D. Contractor shall provide custom plates where necessary to support the designed signal and/or connector types.

E. Manufacturers: Crestron, Extron, Liberty AV, or approved equal

PART 3 - EXECUTION

3.01 EQUIPMENT LOCATION

A. Coordination: Where device locations are not shown on rack/console elevations and project drawings, Contractor shall coordinate with Consultant to identify desired/optimal locations.

B. Contractor shall verify all wall-mounted monitor mounting heights on preconstruction submittals.

3.02 AESTHETIC REQUIREMENTS

A. Printing: Button labels shall be engraved where applicable, or machine-printed where no engraved button/bezel is available. Handwritten labels are not acceptable.

B. Graphics: Icons and graphic representations of equipment and functions shall be crisp, sharp, and easy to identify. Icons shall be used wherever possible.

C. Text: ICS screens shall not use uncommon abbreviations. Text shall be sans serif and shall be sized to be clearly readable.

3.03 EQUIPMENT CONFIGURATION

A. Labeling: Contractor shall configure all equipment for normal use, including setting of levels and presets. Small adhesive labels shall be affixed to equipment indicating nominal levels and settings.

B. EDID, E-EDID: Where devices allow for the customization of EDID information, Contractor shall configure EDID settings of all applicable devices such that the audiovisual system is optimized.

C. Software: Contractor shall utilize Manufacturers official current version of configuration software. Special exemption may be obtained from Consultant if current version contains known issues. In such event, the version immediately preceding shall be utilized.

D. IP Interface: Contractor shall configure/modify IP-based monitoring software to allow Owner to monitor all rooms installed as part of this work. Automatic timed system shutdown shall be configured as part of this software. Shutdown time(s) to be coordinated with Owner.

E. Control System: Contractor shall make adjustments to programming as required by Consultant up to issuance of substantial completion punch list at no additional charge, so long as changes relate to equipment in this bid package.

3.04 DIGITAL SIGNAL PROCESSOR

A. Processor power required of DSP shall not exceed 80% total processing capacity. If processing power required exceeds available processing power, Contractor shall immediately notify Consultant during pre-installation phase.

B. Functional Requirements

1. Functions: The DSP shall be configured to provide:
    a. Pre-amplification
    b. Filtering and Equalization
    c. Dynamics processing
    d. Gating
    e. Mixing, Automatic mixing – gain sharing or gated
    f. Zoning
    g. Mix-minus
    h. Delay
    i. AEC
    j. Volume control
    k. Emergency/Alarm muting
    l. Signal metering
    m. Logic functions
2. Gain Structure: The DSP shall be configured to obtain and maintain unity gain structure from input pre-amplification stage to output stage or associated end-user volume control.
3. AEC: The DSP shall be configured to provide AEC for all microphones detecting echo in conferencing and specialty DSP applications. AEC shall be configured per DSP Manufacturer's recommendations and best practices.
4. AEC and Pre-AEC: Where microphones used for speech / sound reinforcement are part of a conferencing system requiring AEC processing, the "Pre-AEC" audio path shall be utilized for speech / sound reinforcement while a separate path processed for AEC shall be utilized for conferencing.
5. Organization: Referring to open-Architecture DSP platforms. Processing objects shall be clearly labeled and organized clearly to follow the intended signal path from left to right, top to bottom. Connection lines between objects shall be routed in an organized fashion.
6. Multiple DSP: Where designs include more than one DSP linked via virtual multi-channel audio buss or digital audio network, all signals shall be routed to a central processor for master routing and 3rd party control. All control points being controlled by ICS controls shall be located on a single DSP operating as the master unit.
7. Latency: Also known as propagation delay, Programmer shall utilize sufficient and efficient processing paths to achieve intended results whilst minimizing latency from input to output.

C. DSP Controls

1. Contractor shall coordinate work of ICS Programmer and DSP Programmer.

2. Volume controls shall be range limited within DSP to provide end-user with adequate adjustment range (typically +/-6dB for microphones and +/-10dB for presentation sources). Operation of DSP from end-user standpoint shall be seamless with ICS system operation.

3. Processing objects within Audio DSP configuration shall be clearly identified where controlled by ICS. Text objects or similar shall identify these objects.

3.05 IT COORDINATION

A. General: Where connection between components or control features are accomplished over the Owner's LAN, Contractor shall coordinate with Owner's IT department for IP addresses, firewall access, and other issues pertaining to successful integration.

B. Permission: It is Contractor's responsibility to obtain necessary information and permissions to implement their system. Any delays or problems with gathering information or coordinating access to the LAN or WAN shall be brought to Consultant immediately for resolution.

C. Wireless Access Points: In systems where there is a dedicated AV network with it's own WAP(s), the Contractor shall coordinate with the Owner's IT department for all WAP channel configuration, placement, and coverage. Ensure audio visual control system WAP is not treated as a rogue WAP by the Owner's wireless management system.

3.06 SYSTEM TESTING

A. Contractor shall check that all cables are properly labeled and secured prior to substantial completion inspection.

B. Contractor shall ensure that all work areas are clear of all debris, tools, empty boxes, and extra parts prior to substantial completion inspection.

C. Prior to the substantial completion inspection, Contractor shall notify the Consultant that all items listed below are complete:

1. Contractor shall ensure that all standard functions of equipment are functional.

2. Contractor shall verify all input and outputs of the system for signal quality.

3. Audio: Contractor shall verify all sources are free of destructive noise (excessive noise floor, hiss, grounding interference) and that speakers function properly. The audio system shall be consistent in terms of volume and tone and shall be optimized for the space(s) served by the audio system.

a. Control functionality, verification of presets, volume controls, mute controls, etc.

b. Stable operation, completely free of feedback and distortion throughout entire range of available ICS controls.

c. Correct routing of all signals to intended destinations.

d. Unity gain structure.

e. Output transducer (speaker) protection processing functionality.

f. AEC functionality.

g. Provide measurement test results per ANSI/InfoComm 1M-2009 ACU.

h. Outdoor sound system measurements shall be provided at a minimum of one measurement location per 50 seats. Measurements shall be performed using pink noise test signal at a volume congruent with nominal system operation. Measurements shall indicate:

i. Site plan map of seating areas and test locations.

ii. Frequency response from 80Hz-16kHz in 1/3 octave resolution.

iii. SPL (A weighted) of the test signal as measured from each location.

iv. Weather conditions at time of test; including temperature, humidity and average wind speeds.

4. Video: Contractor shall verify that all EDID and EDID-D information has been configured at each video transmission and processing device. Where signal processing is present, Contractor shall optimize the video system to native resolution of display devices.

D. Testing & Adjusting

1. The Contractor will be responsible for adjusting the installed system and notifying the Consultant when system adjustments have been completed:

a. In accordance with Construction Documents

b. As required, to provide the Owner a fully functional system at system turnover

c. As directed by the Consultant

2. Audio System Equalization

a. Using a Real-Time audio frequency spectrum analyzer, such as Audio Control SA-3052 or equivalent, with both 1/3 band and narrow band display, equalize all loudspeaker systems to provide a suitable frequency response as follows:

i. For each indoor sound system measurements shall be provided at a minimum of one measurement location per room quadrant - (approximately 100 square feet). Measurements shall be performed using a pink noise test signal at a volume congruent with nominal system operation.

ii. Measurements shall indicate:

a. Floor plan map of room, seating areas and test locations.

b. Flat Frequency response from 60 Hz to 20 kHz + or – 1-1/2db with a 1db per 1/3 octave roll off after 2kHz.

c. SPL (A weighted) of the test signal as measured from each location.

d. Load and save the final normal settings in the DSP as preset one and record same settings including system gain and amplifier level settings in the As-Built Project Manual

E. Notification: When above tests have been completed and system is ready for inspection, notify Consultant in writing at least seven working days prior to inspection. Include in this notice copies of all data recorded, date each test was completed and results of each test. All test data shall be available during inspection process.

F. Immediately prior to final inspection, in the presence of Consultant and/or Owner representative, Contractor shall load DSP program and integrated control system program from Closeout Submittal media and demonstrate full system functionality.

3.07 FIRMWARE

A. Firmware upgrades shall be dated the same as Date of Acceptance. Contractor shall upgrade firmware and software as necessary during project so that latest versions are installed as of Date of Acceptance.

3.08 TRAINING

A. General Information: As required by Sections 27 00 00 and 27 40 00.

B. Contractor shall provide one (1) 60-minute training session for each unique audiovisual room type. Training sessions shall comprise of one half of the time dedicated to instructor led training with the remainder of the session to be used for instructor supervised hands-on end user operation of the system(s):

1. Identification of input locations, source devices, control locations, displays, and other devices requiring end user interaction for successful system operation.
2. Use of control system.
3. Use of source devices and input locations.
4. Switching inputs for each display.
5. Training shall include operation of system in event of control system malfunction – all manual switching and use of remotes.
6. Basic troubleshooting for common user errors.

C. Scheduling: Training shall be scheduled with Owner at least ten (10) days in advance.

D. Quick-Reference Guides: Contractor shall compile quick-reference guide for system operation and basic troubleshooting. Quick-reference guide shall be provided at the training session, and training shall include walking through quick-reference guide steps.

End of Section

SECTION 27 5113 – PAGING SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. System installation shall include, but not be limited to, installation, programming, and configuration of system components as well as all associated software upgrades, patches, and maintenance for the first year.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 60 00 – Physical Security General Requirements

I. Section 27 62 00 – Electronic Access Control System

J. Section 27 64 00 – Video Surveillance System

K. Section 27 66 00 – Intrusion Detection System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional requirements.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

B. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the distributed communications system(s) being provided.

C. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the distributed communications system(s) hardware.

D. Submittal: Certification certificate shall be submitted with distributed communications system(s) submittals.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

B. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

C. Qualifications

1. Provide certificates for employees working on this project that show they meet the necessary qualifications described in the preceding section above.

D. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, and Quantity.

E. Color Selection List

1. Provide a list of all paging equipment that will be visible to staff and visitors. Include a simplified description of the equipment that a non-technical person (i.e. Architect) can understand. Examples of such items include but are not limited to speakers, volume controls, microphones, and input plates.

2. For each item on the list, include all available color/finish options, with a checkbox next to each option for the Architect or Owner to select.

3. The Paging Contractor must receive confirmation of color selection from the Architect or Owner in writing before ordering any materials that will be visible after installation. If the Contractor fails to complete this step, the Owner reserves the right to object to an installed device’s color and require that the Contractor replace it at no cost to the Owner

F. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

G. Shop drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

a. Floor Plans: Include device/equipment locations, speaker tap values based on speaker models and installation conditions, cable routes, maximum cable distance calculations, zone delineation map, installation notes, and electrical coordination notes (specific conduit routing, etc.).

b. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

c. Equipment Rack/Cabinet & Wall Equipment Elevations: Include placement of all rack/cabinet or wall-mounted equipment, drawn to scale

d. Amplifier power calculations

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Network Device Schedule

1. Provide a schedule of AV devices requiring IP addresses from the Owner. The schedule shall include columns for relevant information such as Manufacturer, Model, MAC Address, Serial Number, Description, Location, etc. The Contractor shall provide additional information when required by the Owner to assist them in assigning IP addresses.

B. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.09 PRE-INSTALLATION PROCEDURES

A. Refer to section 27 00 00 for additional requirements.

1.10 MOUNTING AND INSTALLATION

A. Contractor shall provide the appropriate mounting hardware for all ceiling types and wall types where devices will be located.

B. Exterior devices shall be installed in a sealed backbox with a weather hood.

1.11 CODE AND STANDARD REQUIREMENTS

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and any other codes as required by the AHJ.

B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. Other applicable codes and standards are as follows:

1. ANSI/IEEE C2 – National Electrical Safety Code

2. NFPA 70 – National Electrical Code

3. TIA/EIA 568-C-1, 2, 3 Standards

PART 2 - PRODUCTS

2.01 PAGING SYSTEM GENERAL DESCRIPTION

A. The Contractor shall provide a turnkey paging and public address system that meets all the functional requirements described in this specification plus any additional features necessary to make the system fully operable.

B. The Contractor shall provide all components necessary – both hardware and software – to support a fully functional system, regardless of whether they are explicitly described in this specification. Any Contractor responding to this specification must be an experienced integrator of the solution they are proposing.

C. Areas equipped with local volume controls shall have an emergency override circuit.

D. Speakers in wet areas shall have moisture resistant features.

E. Provide transient and surge protection on both ends of the cabling run for any component exposed to the exterior.

F. Provide zone controllers as necessary.

G. The system shall be capable of connecting to a VoIP telephone or analog PBX system to initiate intercom calls or pages.

1. The Contractor shall provide the interface that is compatible with the Owner's system.

H. The system shall be fully firmware and software upgradable from a centralized network location.

I. All software required for programming and licenses required for operation of the system shall be provided.

J. The system shall include the ability to play music and other auxiliary audio sources via a line level input.

K. The system shall have the ability to store audio files

L. The system shall have the ability to schedule recurring playback of recorded audio files, including music, bells, and recurring announcements. The scheduling software shall allow users to create multiple bell/event schedules and simply apply these to various days on a recurring basis (ex: a different schedule for Monday/Wednesday/Friday and Tuesday/Thursday). The scheduling shall include a calendar interface so that it can be revised for each individual calendar day without affecting the other dates in that recurring sequence.

2.02 PAGING SYSTEM SOFTWARE

A. The Contractor shall install client station software for the administration and management of the system on two (2) workstations of the Owner's choosing.

2.03 PAGING SYSTEM MANUFACTURER

A. K-12 Public Address & Bell Systems with Classroom AV Integration

1. Audio Enhancement

2.04 PAGING ZONES

A. The system shall be wired and configured to support paging individual areas of the building. The following zones shall be included at a minimum:

1. Classrooms, one zone per wing per floor
2. Hallway/common areas, one zone per wing per floor
3. Reception / front office
4. Other staff offices
5. Gymnasiums
6. Library / media center
7. Cafeteria
8. Kitchen
9. Auditorium
10. Pool
11. Locker Rooms
12. Exterior speakers, minimum one zone per cardinal direction

B. The Contractor shall confirm the desired zone groupings with the Owner. The zones listed above are a starting point, not a final list. The Contractor shall include any necessary programming time to re-configure the available zone groupings and naming conventions based on Owner input after the initial training and testing is complete.

2.05 AUDIO AMPLIFIERS

A. The Contractor shall furnish and install the appropriate number and size of amplifiers to support the system, taking into account the quantity of speakers, anticipated tap values, signal loss over cable distance, number of zones, and other associated factors.

B. Amplifiers shall never operate at more than 80% of their rated power.

C. Manufacturers:

1. Audio Enhancement CZA-1300

2.06 CABLE

A. Cable shall be provided and installed that meets the manufacturer's recommendations for equipment and signal types that are being transmitted.

B. UTP cable (Cat6, Cat6A) shall meet the requirements identified in 27 15 00 Communications Horizontal Cabling.

C. 25v/70v speaker cable shall be a minimum of 16 AWG, 2-conductor, twisted cable.

D. 25v/70v speaker cable with volume control bypass trigger shall be a minimum of 16 AWG, 4-conductor, twisted cable.

E. All above-ceiling cabling shall be plenum rated.

F. Manufacturers:

1. Belden
2. Liberty
3. West Penn
4. Windy City Wire

2.07 SPEAKERS

A. The appropriate speaker type shall be installed at each location based on the architectural conditions of that space, including the ceiling type, ceiling height, presence or absence of moisture, light fixtures, wall construction, and other characteristics. The technology floor plans may provide a speaker type number at each location, but it shall be the Contractor's responsibility to ensure the speaker type that gets installed matches the architectural conditions at the time of installation.

B. The speaker models listed below shall be the basis of design, and any proposed substitutions must match the performance characteristics of the specified models.

C. All speakers shall be provided with the appropriate transformer type and/or IP interface necessary to work with the overall system and achieve the functionality described.

D. All speakers shall be provided with the appropriate mounts and accessories necessary for installation.

E. In addition to their primary means of support, all ceiling-mounted speakers shall have a 2-point security wire attached to the building structure to prevent the speaker from falling if the ceiling should lose its structural integrity.

F. Manufacturers:

1. General area cut-in ceiling speakers – Lowell RPAK-810-72
2. Indoor wall speakers – Audio Enhancement SP-1028
3. Indoor/Outdoor paging horn – Lowell LH-15TA or equivalent

2.08 VOLUME CONTROLS

A. Single-gang device

B. Rotary volume control knob with hard stops at lowest and highest settings (no continuous rotation)

C. Match plate color with light switches or provide in stainless steel if no matching option is available.

D. Provide volume control wattage as appropriate for the downstream load.

E. Provide solution with priority bypass relay for emergency override such that users in a volume-controlled area still receive all emergency announcements.

F. Manufacturer: Audio Enhancement PA-0191 or equivalent

2.09 MASTER STATION

A. The master station (also referred to as an admin console, or front office console) shall include an integrated video display, speakerphone, and telephone handset. The master station shall allow users to select any zone or grouping of zones, including individual classrooms if applicable, and make a live announcement or initiate a pre-recorded announcement or other audio file.

B. Provide master stations at the following locations:

1. Front reception desk

2. Secondary location as determined by Owner

2.10 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. A. Provide a UPS battery backup for continuous operation during power failure for 30 minutes at half load.

B. Manufacturers:

1. APC

2. Middle Atlantic

3. Tripp-Lite

2.11 LOCAL SOUND SYSTEM INTEGRATION

A. Provide hardwired audio feed into every local sound system. This includes sound systems for event spaces (gymnasiums, auditoriums, weight room, etc.).

B. Coordinate the connection point and requirements with the AV Contractor. Typically, the feed goes to the AV rack and terminates at an audio processor or mixer. In the case of smaller rooms, this location may be behind the display or in a ceiling enclosure.

2.12 FIRE ALARM INTEGRATION

A. Provide a hardwired direct connection between the fire alarm system and the paging & public address system. Coordinate the wiring requirements and panel location with the Fire Alarm Contractor.

B. Confirm with Owner and Fire Alarm Contractor how the paging/PA system should respond to a fire alarm event. Provide all necessary equipment, wiring, and programming to support any of the following scenarios:

1. Mute the paging/PA system during a fire alarm event

2. Duck the paging/PA system during a fire alarm event

3. Play pre-recorded message during the fire alarm event.

2.13 ACCESS CONTROL INTEGRATION

A. Provide a hardwired direct connection between the access control system and the paging & public address system. Coordinate the wiring requirements and panel location with the Access Control Contractor.

B. Confirm with Owner and Access Control Contractor how the paging/PA system should respond to a Lock Down event. Provide all necessary equipment, wiring, and programming to support the event.

2.14 BLUE LIGHT INTEGRATION

A. Provide a hardwired direct connection between the existing Blue Light system and the paging & public address system. Coordinate the wiring requirements and panel location with the Blue Light Contractor.

B. Confirm with the Owner and Blue Light Contractor how the paging/PA system should respond to the following scenarios and provide the appropriate equipment, wiring and programming to support:

1. Scheduled bell event.
2. Paging event.
3. Lock Down/Emergency event.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.02 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.03 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.04 INSTALLATION PRACTICES

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and functional intercom and PA system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

3.05 PHONE SYSTEM INTEGRATION

A. The Contractor shall connect the paging system to the Owner's IP phone system via a SIP trunk to allow paging from the phone system.

3.06 SYSTEM CONFIGURATION

A. The Contractor shall work with the Owner to create (or import) their bell schedule.

B. The Contractor shall obtain building floor plans and load them into the paging headend hardware/software.

3.07 COORDINATION

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with network configuration.

B. Verify that the manufacturer approved or recommended server hardware and operating system meets the Owner's IT department standards prior to ordering.

C. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.

D. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.08 TRAINING

A. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 12 hours of scheduled and dedicated training time in four (4) three (3) hour sessions for administration and management of the systems.

2. Contractor shall provide up to 2 hours of scheduled and dedicated training time for maintenance personnel.

3. Provide printed training materials for each trainee, including product manuals, course outline, workbook and student guides.

4. Provide hands-on training with operational equipment.

5. Training shall be oriented to the specific systems being installed under this contract as designed and specified.

6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.09 AESTHETICS

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. All surface-mounted devices shall be firmly secured level and plumb

D. All rack mount equipment shall be securely installed.

3.10 HARDWARE LAYOUT

A. Hardware positioning and layout shall be reviewed and approved by the Consultant and Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.11 DEVICE CABLING/WIRING INSTALLATION PRACTICES

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 05 00 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. 70-Volt speaker cabling shall not share cable pathways with other cabling.

D. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

E. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

F. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

G. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

H. Cables shall not run above red iron joist.

I. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

J. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

K. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

L. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

M. No splices shall be installed in any UTP cable unless prior approval from Consultant is given.

3.12 CABLE TERMINATION

A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.13 INTEGRATION WITH PHYSICAL SECURITY SYSTEMS

A. The intercom system shall be integrated with the video surveillance system, electronic access control system and intrusion detection systems.

1. The integration interface shall be via an Ethernet interface.

2. The intercom to video surveillance integration shall be via SIP (Session Initiation Protocol) interface.

a. The intercom stations shall operate in a SIP to SIP mode with the video surveillance system listening and recording the audio to the associated camera time synchronized for seamless video/audio playback.

B. The intercom stations shall be associated with cameras from the video surveillance system.

C. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreement.

D. The Contractor shall provide any needed expansion boards for integration.

E. The system shall integrate with Microsoft Active Directory.

F. The system shall integrate with Microsoft Exchange Server for the purpose of sending email notifications.

G. Refer to each integrated systems specification sections for additional specific integration requirements.

H. The intercom and PA systems shall be time syncing to a common NTP server as all the integrated systems.

I. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the installation and integration starts.

3.14 FIRE STOPPING

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for this Contractor and left unused shall be sealed up by this Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

D. Any existing openings discovered that should be fire stopped should be brought to the attention of the Owner.

3.15 SYSTEM TESTING PROCEDURES

A. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer's instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

B. Contractor shall ensure that each device in the system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

C. Contractor shall be responsible for the following testing procedures:

1. Measure each area's ambient noise level during normal business operation.

2. Provide amplifier(s) and estimate speaker transformer tap values that provide acceptable performance without exceeding 80% of the amplifier's RMS power.

3. Acceptable performance is deemed to mean that a voice page or intercom call is 15 dB over the Ambient Noise level when measured at 5 feet above finished floor. Make all necessary adjustments per Owner and Consultant request.

D. This Contractor is ultimately responsible to ensure the overhead paging system voice pages are a minimum of 15 dB over the Ambient Noise Level in each area without exceeding 80% of the amplifiers' rated power.

E. Inspection: After Contractor's testing is complete and the system is properly adjusted, the Contractor shall contact the Owner to schedule a "spot test" of the system with the Owner and Consultant. Contractor shall make changes/adjustments per Owner and Consultant's request at no additional cost to Owner. These adjustments may include but not be limited to:

1. Adjusting volume control of amplifier.

2. Adjusting local volume control of individual speaker.

3. Re-tapping up to 20% of speakers at different wattage.

3.16 SYSTEM INSPECTION

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

3.17 LABELING

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

3.18 DOCUMENTATION

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 00 00 and 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.

2. Contractor shall provide a document including the following:

a. Device label/identifier

b. Location of each drop by orientation/permanent landmark in the room

c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.19 PRE-CHECKOUT

A. The Contractor shall demonstrate the following to Owner during system demonstration:

1. The intercom stations are fully installed and functional.

2. Calls can be placed and operate in full duplex mode.

3. All-call functionality is working correctly.

4. Individual zones can be paged.

5. Integrations are functional.

3.20 FINAL ACCEPTANCE

A. In addition to closeout requirements in section 27 00 00 and 27 60 00, This Contractor shall demonstrate the following before final approval.

1. Owner training is complete.

2. Punch list items are complete.

3. As-built documentation is complete and submitted to Owner/Consultant.

3.21 FINAL PROCEDURES

A. Perform final procedures in accordance with section 27 00 00 and 27 60 00.

End of Section

SECTION 27 5313 – SYNCHRONIZED CLOCK SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. This section describes the products and execution requirements relating to synchronized clocks and connection to a master clock if applicable.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 15 00 – Communications Horizontal Cabling

D. Section 27 16 00 – Communications Connecting Cords

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

C. Color Selection List

1. Provide a list of all synchronized clock equipment that will be visible to staff and visitors. Include a simplified description of the equipment that a non-technical person (e.g., an Architect) can understand. Examples of such items include analog and digital clocks.

2. For each item on the list, include all available color/finish options, with a checkbox next to each option for the Architect or Owner to select.

3. The Clock Contractor must receive confirmation of color selection from the Architect or Owner in writing before ordering any materials that will be visible after installation. If the Contractor fails to complete this step, the Owner reserves the right to object to an

installed device's color and require that the Contractor replace it at no cost to the Owner.

D. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Network Device Schedule

1. Provide a schedule of AV devices requiring IP addresses from the Owner. The schedule shall include columns for relevant information such as Manufacturer, Model, MAC Address, Serial Number, Description, Location, etc. The Contractor shall provide additional information when required by the Owner to assist them in assigning IP addresses.

B. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 MASTER CLOCK

A. The clocks provided in this project must be compatible with the Owner's existing master clock / time server. The Contractor shall be responsible for connecting and configuring the clocks to follow this master clock.

1. Existing master clock: Sapling SMA 2000 Series

2.03 DIGITAL SECONDARY CLOCKS

A. Provide clocks at all locations indicated on the technology plans. Digital clocks are designated with a subscript "D" and a number to indicate single ("1") or double-sided ("2").

B. Clock technologies:

1. IP network-based with Power over Ethernet (PoE)

C. All clocks shall have built-in self-diagnostics and be configured for email alerts when there are the following errors:

1. NTP synchronization timeouts

2. Power resets

D. Clock requirements

1. 4”H digits
2. Red LED color
3. 4-digit display (00:00)
4. 12- or 24-hour display (adjustable/configurable)
5. Immediate correction for time change
6. Adjustable brightness settings
7. UL and cUL listed
8. Mounts to a standard-sized gang box
9. No external screws visible on the bezel or housing

E. Provide with appropriate mounting accessories, which may vary by location. Include a dual-sided clock mount where indicated on the plans.

F. Manufacturers:

1. Sapling

2.04 PROTECTIVE COVERS

A. In spaces where the clock needs additional protection to avoid damage, provide a clear polycarbonate guard/cover.

B. Applies to gymnasiums and anywhere else that the clock is likely to be hit.

2.05 CABLE

A. IP solutions:

1. Refer to structured cabling specifications, 27 05 00 thru 27 15 00.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.02 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.03 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.04 SECONDARY CLOCKS

A. Clocks shall be configured to receive time data from an NTP or SNTP server or from a master clock.

B. Contractor shall confirm preferred configuration with Owner during installation.

C. Contractor shall add up to ten (10) NTP sources of the Owner's choosing.

D. Contractor shall configure email alerts for errors/failures and confirm with Owner the email address(es) to receive these alerts.

End of Section

SECTION 27 6000 – PHYSICAL SECURITY GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 27 00 00 for additional project scope information. This section describes the general product and execution requirements related to furnishing and installing Physical Security Systems. Physical Security Systems includes Video Surveillance, Electronic Access Control, Intrusion Detection, and their sub systems.

B. Contractor shall be responsible for providing complete and functional systems as described in this specification and project drawings.

C. Contractor shall provide low voltage power and control lines to and from power supplies, remotely controlled equipment, and other devices, even though not explicitly indicated on drawings or listed in equipment tables.

D. Contractor shall be, or Contractor shall provide, an Electrical Contractor for provision of high voltage power and conduits/raceway, where necessary.

E. Contractor shall be responsible for any and all related programming and end-user training unless noted otherwise.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 51 00 – Distributed Communications Systems

I. Section 27 62 00 – Electronic Access Control System

J. Section 27 64 00 – Video Surveillance System

K. Section 27 66 00 – Intrusion Detection System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 27 00 00 for additional requirements.

B. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the physical security system(s) being provided.

C. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the physical security system(s).

D. Submittal: Certification certificate shall be submitted with physical security system(s) submittals.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

B. Hardware, Application Software, and Network Requirements: A system description including analysis and calculations used in sizing equipment required by the Physical Security Systems. The description shall show how the equipment will operate as a system to meet the performance requirements of the systems. The following information shall be supplied as a minimum:

1. Server(s) processor(s), disk space and memory size
2. Workstation(s) processor(s), disk space and memory size
3. Operating System(s) Software, where software is provided or upgraded
4. Application Software, with Optional and Custom Software Modules supplied in this project
5. Integration Schemes: Proposed connectivity, software, development requirements, and SDK information, for inter-system communication.
6. Network reliability requirements
7. Number and location of LAN ports required
8. Number of IP addresses required.
9. Other specific network requirements, preferences, and constraints
10. Backup/archive system size and configuration
11. Start-up operations
12. Description of site (field) control equipment (Controllers/Field Panels) and their configuration
13. Access control power calculations.
14. Battery backup requirements

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

B. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

C. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.02 GROUNDING AND BONDING

A. The Contractor shall bond and ground the primary protectors and the metallic member of cable sheaths to building ground utilizing a minimum of 14-awg and no greater then 6-awg at the closest point of entrance as practical, not exceeding 50 feet, in accordance with the NEC.

2.03 REFER TO INDIVIDUAL SECTIONS FOR ADDITIONAL PRODUCT INFORMATION.

2.04 FIRE STOPPING MATERIALS

A. Refer to Section 27 00 00 for additional requirements.

PART 3 - EXECUTION

3.01 NETWORK TIME PROTOCOL (NTP) SYNCHRONIZATION

A. All security systems as well as additional integrated systems such as intercom/PA, SQL/database servers and data logging servers shall synchronize to a common NTP server.

B. All systems including servers and workstations shall be within 250ms of each other or less depending on specific system requirements. The synchronization frequency shall be no less than every 1 hour.

C. The Contractor shall coordinate with the Owner for a NTP server connection address.

3.02 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.03 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

B. On-Site Training

1. General: Present, review and describe equipment and materials to the Owner and Owner's operating personnel and fully demonstrate the operation and maintenance of the systems, equipment and devices specified herein.

2. Include with new systems, Contractor to arrange and provide for video recording of each onsite training session.

a. Provide professional video and audio recording of each software screen option with Owner approval of content.

b. Provide end user video recording for all training levels.

3. Training shall comprise two separate levels of training;

a. User Group upon substantial completion of the project.

i. User group training shall include a site/building walk through indicating locations of equipment and their usage.

ii. User group training shall include the operation of workstation capability of system monitoring, command override and report generation.

b. Maintenance Group upon completion of the project prior to close out.

i. Maintenance group training shall include a site/building walk through indicating locations of equipment and their usage at up to six representative sites.

ii. Review of a-build documentation at each controller location.

iii. Troubleshooting techniques in hardware and software.

4. The training shall cover the overall system, each individual system, each subsystem, and each component. The training shall also cover procedures for database management, normal operations, and failure modes with response procedures for each failure. Each procedural item shall be applied to each equipment level.

C. Duration: Refer to the individual sections for the minimum time requirements.

3.04 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

B. Furnish and guarantee maintenance, repair and inspection service for the system using factory trained authorized representatives of the manufacturer of the equipment for a period of one year after final acceptance of the installation.

C. Third Party Device warranties are transferred from the manufacturer to the Contractor, which may then transfer third party warranties to the Owner. Specific third party warranty details, terms and conditions, remedies and procedures, are either expressly stated on, or packaged with, or accompany such products. The warranty period may vary from product to product. These products include but are not limited to devices that are directly

interconnected to the field hardware or computers and are purchased directly from the manufacturer.

D. Purpose

1. The Contractor shall repair any system malfunction or installation deficiency discovered by the Owner or their representatives during the burn in and warranty period.

2. The Contractor shall correct any installation deficiencies found against the contract drawings and specifications discovered by the Owner or their representatives during the warranty period.

3.05 EXAMINATION OF SITE AND DOCUMENTS

A. Bidder shall examine all documents, shall visit the site(s) prior to submitting proposal, record their own investigations, and shall inform themselves of all conditions under which the Work is to be performed at the site(s) of the Work, including the structure of the ground, the obstacles that may be encountered, and all of the conditions of the documents, including superintendence of the Work, requirements of temporary environmental controls, the time of completion, list of Subcontractors, and all other relevant matters that may affect the Work or the proposal process.

B. Verify cable lengths comply with published standards.

C. Notify Owner/Consultant of installation that would exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner/Consultant regarding alternative routing or location of cable.

E. Do not proceed until unsatisfactory conditions have been corrected.

F. Failure to make the examination shall not result in any Change Order requests.

G. The Bidder shall base the proposal on the site(s) examination, materials complying with the plans and specifications and shall list all materials where the proposal form requires.

H. The commencement of work by the Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to the Owner/Consultant prior to commencement.

I. If the Contractor observes, during preliminary examinations or subsequent work, existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, the Contractor shall report these to the Owner/Consultant in a timely manner.

3.06 INSTALLATION REQUIREMENTS

A. Refer to Section 27 00 00 for additional requirements.

B. Contractor shall furnish and install all cables, connectors, and equipment as shown on Drawings and as specified herein.

C. It is the Contractor’s responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

D. Beginning installation means Contractor accepts existing conditions.

E. The Contractor shall be responsible for identifying and reporting to the General Contractor any existing damage to walls, flooring, tiles, and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway, or other hardware shall be repaired by the Contractor.

F. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor-damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

G. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

H. All wiring shall be run “free-air,” in conduit, in a secured plastic raceway or in modular furniture as designated on the Drawings. All cable shall be free of tension at both ends. PLENUM rated cable shall be used in areas used for air handling.

I. Avoid abrasion and other damage to cables during installation.

J. The cable system will be tested and documented upon completion of the installation as defined in the section below.

K. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by manufacturers or as indicated in their published literature, unless specifically noted herein to the contrary.

3.07 COOPERATION

A. The Contractor shall cooperate with Consultant’s and Owner’s personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.08 COMMISSIONING SUBMITTALS

A. Provide the following to the Owner no later than 30 days prior to system commissioning/programming.

1. Commissioning Test Plan and Check-Off List: Specified elsewhere in this document.

2. Software: One set of fully functional software in manufacturer’s original media packaging, temporarily licensed for a 30-day evaluation period.

3. Web-based Training: Access to web-based training modules.

3.09 COMMISSIONING

A. Provide programming and commissioning for each system as described in individual sections below.

B. This Contractor shall develop and submit a plan for coordination of settings and programming issues with the Consultant and Owner no later than 30 days prior to performing programming and commissioning.

C. The security Contractor is required to place entire system into full and proper operation as designed and specified.

D. Verify that all hardware components are properly installed, connected, communicating, and operating correctly.

E. Verify that all system software is installed, configured, and complies with specified functional requirements.

F. Perform final acceptance testing in the presence of Owner's representative, executing a point-by-point inspection against a documented test plan that demonstrates compliance with system requirements as designed and specified.

1. Submit documented test plan to Owner at least 14 days in advance of acceptance test, inspection, and check-off.

2. Conduct final acceptance tests in presence of Owner's representative, verifying that each device point and sequence is operating correctly and properly reporting back to control panel and control center.

3. Acceptance by Owner is contingent on successful completion of check-off; if check-off is not completed due to additional work required, re-schedule and perform complete check-off until complete in one pass, unless portions of system can be verified as not adversely affected by additional work.

4. The system shall not be considered accepted until all acceptance test items have been successfully checked-off. Beneficial use of part or all of the system shall not be considered as acceptance.

3.10 OPERATION AND MAINTENANCE MANUALS

A. Part One: Notwithstanding requirements specified elsewhere, submit the following labeled as the "Operating and Maintenance Manual" within thirty (30) days after Final Acceptance of the Installation:

1. Record Drawings: Submit two (2) copies of revised versions of drawings as submitted in the "Shop and Field" and "Equipment Wiring Diagrams" Submittals showing actual device locations, conduit routing, wiring and relationships as they were constructed. Include nomenclature showing as-built wire designations and colors. Drawings shall include room numbers coinciding with Owner space planning numbering. Drawings shall be submitted in electronic editable AutoCAD 2010 files, in ".dwg" format, on CD or DVD disks.

2. Manuals: Submit two (2) copies of each of the following materials in bound manuals, or electronic PDF copies, with labeled dividers:

a. A final Bill of Material for each system

b. Equipment Instruction Manuals: Complete, project specific comprehensive instructions for the operation of devices and equipment provided as part of this work.

c. Manufacturers Instruction Manuals: Specification sheets, brochures, Operation Manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Include information for testing, repair, troubleshooting, assembly, disassembly and recommended maintenance intervals.

e. Provide a replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

f. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturer's Warranty Registration papers as described herein.

B. Part Two: Within fourteen (14) days of receipt of Consultant reviewed Operating and Maintenance Manual (Phase One), submit three (3) electronic copies in AutoCAD 2010 editable .dwg format of the reviewed Record Drawings and three (3) copies of the reviewed Operating and Maintenance Manuals to the Owner, on CD or DVD disks.

1. Within each equipment enclosure and/or terminal cabinet, the Contractor shall place a Single Line drawing of the system(s) and the respective Terminal Cabinet Wiring Diagram in a clear plastic sleeve permanently attached to the inside cover of the terminal cabinet.

2. In each equipment enclosure the Contractor shall place a drawing providing device locations served by the equipment within the enclosure with identification that is identical to the wiring tags and with the software description of each point.

3. The Contractor shall provide to the Owner one (1) copy of new administration and user software, including required graphical maps, on CD or DVD disks.

C. Sufficient information, (detailed schematics of subsystems, assemblies and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

3.11 CLOSEOUT PROCEDURES

A. Notification: Contractor shall provide written notification to Architect/Consultant and Owner when Contractor is satisfied that the work has been completed and is ready for inspection.

B. Closeout Submittals: Contractor shall provide closeout documentation to the Architect/Consultant. The Architect/Consultant shall receive the closeout submittals no less than 72 hours prior to the scheduled inspection time.

C. Inspection: Contractor shall be present for the inspection by the Architect/Consultant. Contractor shall supply all testing equipment needed to verify compliance with the specifications found in Bid package.

D. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in the Bid package, and/or unacceptable to the Architect/Consultant shall be documented by the Architect/Consultant and provided to Contractor to rectify.

E. Re-Inspection: If a re-inspection is necessary, the costs of the Architect/Consultant's additional travel, hours, and expenses may be deducted by the Owner from the contract amount due Contractor.

F. Punch List Approval: The punch list shall be considered complete only after having been signed by the Owner and Architect/Consultant.

G. The system has successfully completed a 30-day performance period.

H. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by the Owner and Architect/Consultant, including punch list(s) and/or re-inspection(s).

End of Section

SECTION 27 6200 – ELECTRONIC ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. This specification section covers the furnishing and installation of a low-voltage, Electronic Access Control System (EACS) as part of an expansion to the existing system.

B. Contractor shall furnish and install access control hardware devices, mounting brackets, power supplies, switches, controls, consoles and other components of the system as required.

C. Contractor shall furnish and install access control related software to allow this system expansion. Software includes required license addition for access control readers and electrified portals, workstations and required physical security system Integration.

D. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26.

E. Refer to Section 27 00 00 for additional project scope information.

1.02 PRECEDENCE

A. Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

1.03 RELATED WORK

A. Division 08 - Door Hardware

B. Section 27 00 00 – General Technology Requirements

C. Section 27 05 00 – Communications General Requirements

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 05 28 – Pathways for Technology Systems

F. Section 27 05 37 – Firestopping for Technology Systems

G. Section 27 11 00 – Communications Equipment Rooms

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 51 00 – Distributed Communications Systems

J. Section 27 60 00 – Physical Security General Requirements

K. Section 27 64 00 – Video Surveillance System

L. Section 27 66 00 – Intrusion Detection System

1.04 DEFINITIONS

A. ACS – Access Control System

B. IDS – Intrusion Detection System

C. VMS – Video Management System

D. Refer to Section 27 00 00 for additional definitions.

1.05 REFERENCE STANDARDS AND CODES

A. IEC 60839-11-5:2020 - Open Supervised Device Protocol (OSDP)

B. Refer to Section 27 00 00 for additional requirements.

1.06 QUALIFICATIONS

A. The access control contractor, installer and programmer shall be an Avigilon Premier, Elite or Elite Plus dealer.

B. Lock installers for fire rated doors are to be trained and certified by the manufacturer via Intertek Qualified Personnel (IQP) Raceway and Hardware Installer Program on the proper installation and adjustment of fire, life safety, and security products in compliance with NFPA 80 including: hanging devices; locking devices; closing devices; and seals.

1. Trained and qualified raceway installers are required to ensure modifications do not affect the integrity of fire doors. Doors must remain compliant with NFPA 80.

C. Refer to Section 27 00 00 for additional requirements.

1.07 PRE-CONSTRUCTION SUBMITTALS

A. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

C. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

D. Shop Drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-

construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

    a. Floor Plans: Include device/equipment locations, cable routes, maximum cable distance calculations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

    b. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

    c. Wall Equipment Elevations: Include placement of all wall-mounted equipment, drawn to scale.

    d. Hardware Layouts: Include individual panel layouts, showing the number of controllers, sub-panels, and other associated devices per location.

    e. Power Calculations: Include the anticipated power loads, number and type of power supplies including all power supply boards, number of 120VAC circuits required, battery backup including the quantities of batteries to meet requirements, PoE loads, fire alarm connection requirements, etc.

1.08 PRE-INSTALLATION PROCEDURES

A. The Contractor shall cable all controlled or monitored doors, intercoms, etc. and terminate this cable in the access control panels no less than 3 weeks prior to substantial completion regardless of the status of the field devices such as door hardware, card readers, intercoms, etc.

B. The Contractor shall program the access control system no less than 2 weeks prior to substantial completion so when field devices are installed and terminated, associated door hardware and full system functionality can be tested. Programming shall include all doors, associated inputs, outputs, and interoperability regardless of final field device status.

C. The Contractor shall perform final connections and testing onsite when field devices such as electrified door hardware has been installed.

D. Refer to section 27 00 00 and 28 00 00 for additional requirements.

1.09 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 requirements.

1.10 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

1.02 SYSTEM SOFTWARE

A. The Contractor shall expand on the existing software as required. The software is deployed on a primary and failover Avigilon server. User log in and cards holders are controlled by Active Directory. Unlimited partitions are licensed. The software is licensed for 256 readers.

B. Manufacturer:

1. Avigilon Unity (ACM) Enterprise

2. No substitutions

2.01 ELECTRONIC ACCESS CONTROL HARDWARE

A. The Access Control Panel (ACP) is used as the subcomponent to the security management system for the purpose of initiating all decision-making criteria as it relates to the cardholders, readers, and associated hardware connected. Decisions are made by the ACP and uploaded to the host computer as historical events.

B. The ACP shall be listed for Underwriters Laboratory (UL):

1. UL294 (Access Control System)

C. Provide an access control system based off of HID Mercury Security open platform hardware and interface modules. The panels shall:

1. Operate without the need for the host to be on-line. No decisions shall be dependent on the host.

2. Support on-board 10/100 Ethernet communications to the host as primary communication.

3. Include a request-to-exit and door status contact input for each reader without the need for additional modules for future use.

4. Detect “forced entry” and “door left open.” A separate action is required for each.

5. Allow mapping of readers to any output address within the same controller.

6. Support at least 50 user-selected holidays.

7. Allow all unused door logic, such as door strike relays, request-to-exit inputs, and door status inputs to be assigned as general-purpose points.

8. Support optional modules for additional customization of inputs and outputs.

9. Wireless intelligent lock support.

10. Wired intelligent lock support.

11. Elevator support.

12. Maintain historical information for a minimum of three (3) months without AC power.

13. Automatically adjust for daylight savings time and leap year.

14. Support a variety of reader technologies.

15. Support for OSDP V2 and OSDP V2 SC (Secure Channel).
16. Support the following card/reader technologies as a minimum:
    a. Magnetic Stripe
    b. 125KHz Proximity cards
    c. 13.56Mhz Smart Cards and technologies
    d. Biometrics
    e. Vehicle Identification
    f. Support multiple technologies simultaneously.
    g. Support for HID 37-bit card formats.
    h. Support for HID iClass SE and Seos technologies.
    i. Support for NXP and HID MiFare DESFire EV1, EV2 and EV3
17. Maintain the expiration date for each cardholder. Once the date is reached, the card will automatically be disabled. No access shall be authorized.
18. Maintain three (3) access times for each door location: Standard, Long, and Egress.
19. Have the ability to maintain an automatic door unlock during specific hours and days.
20. Support a minimum of (2) “levels” of Anti-Passback: Global and Area.
21. All controllers and expansion modules shall have the latest ACS recommended firmware installed and shall have matching firmware versions. The Contractor shall provide all necessary firmware upgrades to keep the Owner on the latest version throughout the duration of the project. At the completion of the project the Owner shall have the option to receive a final firmware update the latest version before the project is paid in full.

D. Panels shall use HID Mercury Security MP controllers with Series-3 MR interface panels. Legacy LP/EP controllers and Series-2 interface panels are not allowed.
    1. The Contractor shall provide adequate number of access control panels, controllers, door interface panels and I/O panels for a complete turnkey system to support all components as indicated on project drawings, specifications and as required.
    2. Basis of design is MP1502 controllers, MR52-S3 interface panels and MR16IN-S3/OUT-S3 I/O panels.
    3. MP1501 Single door controllers shall only be used when specifically specified or approved by the Consultant.
    4. MR50 single door expansion modules shall only be used when specifically specified or approved by the Consultant.
    5. For RS-485 based intelligent lock installations, expansion module star topologies, or complex installations requiring significant RS-485 connection the Contractor shall utilize Mercury Security MUX8 RS-485 multiplexers.
    6. Mercury Security Series-3 MP1502 Controller:

a. Power Input

i. Direct current (12-24VDC) ±10% 500 mA maximum.

b. Power Output: 12 Volts DC at 650mA including reader and AUX output.

c. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

d. Inputs: Eight general purpose programmable circuit type and dedicated tamper.

e. Outputs: Four relays – Form-C, 2 Amp, 30 volts direct current

f. Onboard Reader Ports: Supports 4 readers on up to 2 openings.

g. RS-485 Bus: (1) RS-485 bus.

h. OSDP Secure Channel support.

i. LED: TTL, two wire or one wire bi-color support

j. Buzzer: One-wire LED mode

k. Supports up to 128 OSDP readers on up to 64 openings with downstream modules.

l. Supports up to 520 inputs and 516 outputs with downstream modules.

m. 240,000 card holder capacity.

n. 2gb to 8gb MicroSD card support.

o. Dimensions: 8”W x 6”H x 1”D.

p. Provide with Mercury Security Series-3 MR52 or other SIO modules as necessary for the application when Mercury controllers are utilized.

q. Provide with an appropriate, lockable enclosure to house the controller as well as the terminations and any expansion modules.

7. Mercury Security Series-3 MR53-S3 Reader Expansion Module:

a. Power Input

i. Direct current (12-24VDC) ±10% 500 mA maximum.

b. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

c. Inputs: Eight general purpose programmable circuit type and dedicated tamper.

d. Outputs: Six relays – Form-C, 2 Amp, 30 volts direct current

e. Onboard Reader Ports: Supports 4 readers on up to 2 openings.

f. Host Communication: RS-485

g. OSDP Secure Channel support.

h. LED: TTL, two wire or one wire bi-color support

i. Buzzer: One-wire LED mode

j. Dimensions: 6”W x 8”H x 1”D.

8. Mercury Security Series-3 MR16IN-S3 Input Expansion Module:

a. Power Input

i. Direct current (12-24VDC) ±10% 350 mA maximum.

b. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

c. Inputs: Sixteen general purpose programmable circuit type and dedicated tamper.

d. Outputs: Two relays – Form-C, 2 Amp, 30 volts direct current

e. Onboard Reader Ports: None.

f. Host Communication: RS-485

g. Dimensions: 6”W x 8”H x 1”D.

9. Mercury Security Series-3 MR16OUT-S3 Output Expansion Module:

a. Power Input

i. Direct current (12-24VDC) ±10% 1100 mA maximum.

b. Reader Interface: 12-24VDC ±10%. PTC limited to 300mA maximum per reader.

c. Inputs: Two general purpose programmable circuit type and dedicated tamper.

d. Outputs: Sixteen relays – Form-C, 2 Amp, 30 volts direct current

e. Onboard Reader Ports: None.

f. Host Communication: RS-485

g. Dimensions: 6”W x 8”H x 1”D.

2.02 ELECTRONIC ACCESS CONTROL SERVER

A. The Contractor shall utilize the existing server.

2.03 CONTACTLESS 13.56 MHZ SMART CARD AND 125 KHZ LEGACY CARD MULTICLASS READERS

A. 13.56 MHz Supported Credentials:

1. HID Seos, iClass SE, iClass SR and iClass with Secure Identity Object (SIO)

2. Mifare DESFire EV1/EV2, Classic

3. Able to read 37-bit card format support with no facility code.

4. NFC based credentials

5. 2.4 GHz based Bluetooth credentials

6. Apple Enhanced Contactless Polling (ECP) capable

B. 125 KHz Supported Credentials:

1. HID Proximity

C. OSDP V2 enabled with secure channel

1. The Contractor shall supply with (2) 120 Ohm end of line resistors for controller side and final reader side of the OSDP bus.

D. Operating voltage: 12 VDC

E. Current draw: 65mA average and 250mA peak @ 12VDC.

F. Color: Black with Silver Bezel

G. UL294 Outdoor and Indoor rated and IP65 rated.

H. With attached pigtail

I. Typical read range of 1.6” to 4”.

J. Provide adapter plate to mount on a single-gang mud ring as required.

K. Firmware upgradable via OSDP, HID reader manager or pre-programmed cards.

L. Provide the ability to transmit an alarm signal via OSDP or an integrated dry contact optical tamper switch if an attempt is made to remove the reader.

M. An audio beeper and RGB light bar shall provide various tone and light sequences to signify: access granted, access denied, power up, and diagnostics.

N. Card readers shall be HID Signo Model 40 for standard applications and model 20 for mullion/jam applications.

2.04 POWER SUPPLIES AND ACCESS CONTROL ENCLOSURES

A. Provide a power supply/chargers and sub-assemblies to power various access controller boards, locking hardware and other access control or security system components. The Contractor shall select the appropriate enclosure, power supply and sub-assemblies for each application. The Contractor shall include network monitoring modules for all power supplies.

B. All power supplies and their supporting infrastructure shall be mounted to fire rated with rating exposed, ¾” plywood secured to the wall. The Security Contractor shall furnish and install this plywood behind all enclosures.

C. All power supplies shall be hardwired by a licensed electrician with 120VAC power on a dedicated circuit.

D. All enclosures shall be bonded to building ground.

E. Enclosures

1. Shall be capable of accommodating power supplies, sub-assemblies and other manufactures access control controller boards when required.

2. Internal components pre-wired at manufacturer including connectors for Mercury panels.

3. Wall mountable.

4. Include a cam-lock and tamper switch. Connect tamper switch to tamper input on access control panel and label as panel door.

5. The following architecture shall be utilized:

a. Select 8, 16 or 24 door/reader enclosure size capacity based on hardwired reader count, never less than 16 door capacity for the main access control panel and never less than 8 door capacity for the remote access control sub-panels.

b. The Secondary enclosure is an expansion enclosure located next to the primary enclosure that connects to the primary power supplies network monitoring module.

c. The remote enclosure is an enclosure that has a network controller located in a different telecommunications closet then the primary.

d. Select multiple primary plus secondary enclosures when hardwired reader count exceeds 16 in a single closet.

6. Include with Panduit finger duct wire management and Velcro straps for pre-installed cable.

7. Pre-wired for Mercury panels. Select proper pre-wire version based on enclosure configuration.

8. Manufacturer:

a. LifeSafety Power ProWire MClass Panduit

i. 16-Door Primary - FPO250/250-3D8P2M8NLXE8M2/P16-A

ii. 16-Door Secondary - FPO250/250-3D8P2M8E8M2/P16-C

iii. 16-Door Remote - FPO250/250-3D8P2M8NLXE8M2/P16-A

iv. 24-Door Primary – FPO250/250/250-5D8P3M8NLXE12M/P24-A

v. 24-Door Secondary – FPO250/250/250-5D8P3M8E12M/P24-C

vi. 24-Door Remote – FPO250/250/250-5D8P3M8NLXE12M/P24-A

F. Power Supplies

1. 120 VAC hardwired input

2. Foor all configurations, furnish FPO250 power supplies.

G. Sub-Assemblies

1. The Contractor shall provide all necessary sub-assemblies to meet the project requirements.

2. Provide with NLX network monitoring module. Wire Mercury panels through NLX relay to enable remote power cycling.

3. Provide with M8, fused intelligent relay distribution modules, quantity as required. PTC self-resetting fuses are not allowed.

4. Provide with D8P, intelligent power limited auxiliary fused output modules, quantity as required including (1) dedicated for Mercury panel power.

5. Provide power switches to shut down power for service.

H. Batteries

1. The Contractor shall provide a minimum of (2) 12V, 7ah, sealed Absorbent Glass Mat (AGM) style batteries with F style terminals per 24 VDC power supply and (1) 12V, 7ah,

sealed Absorbent Glass Mat (AGM) style batteries with F style terminals per 12 VDC power supply.

2. Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 4-hours.

3. Manufacturer:

    a. Interstate Power Patrol FAS1075

    b. Power Sonic PS-1270

    c. Or approved equal

2.05 CABLING

A. Provide cabling per manufacturer's recommendations and code requirements for riser rated, plenum, and non-plenum cable types.

B. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.

C. UTP patch cables will be provided and installed by the Contractor in the IDF and provided and installed by Contractor at the control panels or at the door when required.

D. Wiegand cables for electronic access-controlled doors shall be a composite bundled cable and include the following cables and conductor counts:

1. Card reader, Wiegand – 6 conductor, 22 awg shielded.

2. Lock power – 4 conductor, 18 awg unshielded.

3. Door contact – 2 conductor, 22 awg unshielded. Furnish and install a second 22 awg, 2-conductor cable when the door contact connects to both the access control system and intrusion detection system.

4. Request to exit and/or latch detection/spare – 4 conductor, 22 awg unshielded

5. Manufacturer (Wiegand):

    a. Belden (Wiegand) #658AFJ

    b. General Cable (Wiegand) #4EPL1S

    c. Superior Essex (Wiegand) #AC-A1x-68

    d. West Penn #AC251822B

    e. Or approved equal

E. Cables for RS-485/OSDP in panel or in-panel controller shall be: 2 conductor stranded, twisted, 24 awg, 100% foil shield with 90% tinned copper braid shield with drain, 120 ohm nominal impedance.

1. Manufacturer:

    a. Belden #82841

    b. Or approved equal

C. Cables for controlled doors shall be 16-guage, 2-conductor, unshielded, stranded cable per controlled door. The cable shall be white in color and plenum rated.

F. Cables for intercom trigger wires, door release buttons, and panic/lockdown buttons shall be 18-gauge, four-conductor, unshielded, stranded cable. The cable shall be white in color and plenum rated.

G. Cables for intercom trigger wires or door contacts shall be 18-gauge, four-conductor, unshielded, stranded cable. The cable shall be white in color and plenum rated.

2.06 DOOR CONTACTS/DOOR POSITION SWITCHES (DC)

A. All doors with card readers and all doors shown for monitored only shall have a door position switch. When the door position switches are not shown in the Division 08 specifications, the security contractor shall furnish and install them. The Security Contractor shall be responsible for the connection of all door position devices to the access control system and other systems if sharing the same door position switch. Door position devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements.

B. Sealed and potted magnetic reed switch in contact housing.

C. Provide DPDT for applications with multiple security systems (Access Control/Intrusion Detection) utilizing a single door contact.

D. Door contacts shall be appropriately sized for any established holes within door frames.

E. Parts provided are basis of design. Determination of final part number is the responsibility of Contractor.

F. Provide color that matches door as close as possible.

G. Provide recessed switch whenever possible.

H. Provide armored whip for surface mount contacts.

I. Provide with a 1k/2k end of line (EoL) pre-built resistor pack. GRI (George Risk Industries, Inc.) 6644 series or approved equal.

J. Provide GRI (George Risk Industries, Inc.) 180 Series for recessed applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

K. Provide GRI (George Risk Industries, Inc.) 4400 series for surface mount applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

L. Provide GRI (George Risk Industries, Inc.) MC-180 Series for hollow top channel applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

M. Provide GRI (George Risk Industries, Inc.) 4532 Series for overhead door applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

2.07 REQUEST TO EXIT (REX) DEVICES

A. All doors with card readers shall have a request to exit with the exception of doors with a card reader in and a card reader out. When integrated request to exit devices are not shown in the Division 08 specifications, the security contractor shall furnish and install motion-based request to exit devices. The Security Contractor shall be responsible for the connection of all requests to exit devices integral to the door, motion based or other to the access control system. Request to Exit devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements. Motion based Request to Exit devices shall only be used when not available in the door hardware.

B. Provide with a 1k/2k end of line (EoL) pre-built resistor pack when utilized to release doors with magnetic locks or other high security applications. GRI (George Risk Industries, Inc.) 6644 series or approved equal.

C. Independent adjustable beam pattern.

D. Provide with mounting plate or wall mounting plate to mount over a single-gang backbox when required.

E. Provide white or black color that matches door as close as possible.

F. (2) Form C relay contacts each rated 1 A at 30 VAC or VDC for resistive loads.

G. DC Power draw: 39mA max @ 12 VDC.

H. Dimensions: 1.8”H x 6.75”W x 1.75”D.

I. Utilize contact closure REX hardware built into the handle or crashbar whenever possible.

J. Provide Bosch DS160/161

1. Provide with TP160/161 mounting plate when mounted over a backbox.
2. Or approved equals.

2.08 ELECTRIFIED HARDWARE (EH)

A. The Security Contractor shall be responsible for the connection of all electrified hardware to the access control system. This shall include providing centralized power supplies located next to or integral to the access control panels. The Contractor shall coordinate with the door hardware specifications and schedules for additional information.

2.09 ADA POWER ASSIST DOOR OPERATOR INTEGRATION RELAYS

A. The Contractor shall provide all necessary relays to interface to the ADA operators at access-controlled doors with ADA door operators. The ADA operator interface shall be managed by the access control system. Local “smart relays” that require compiled code are not allowed.

B. Hardwired paddles

1. Provide with a DPDT relay. Replace existing relay in paddle as necessary.

2. Manufacturer:

a. Altronix RB1224

b. Or approved equal

2.10 DOOR RELEASE BUTTON, UNDER COUNTER

A. SPDT, momentary push button

B. Guard ring around button to prevent accidental activation

C. Mount with button facing back of desk

D. Coordinate exact mounting location after deck or counter is fully complete and the sitting position has been decided.

E. Manufacturer:

1. Alarm Controls TS-18

2. Or approved equal

2.11 LOCKDOWN BUTTONS

A. Exact device type and style to be coordinated with Owner prior to approval or purchase. A selection of button options shall be presented to the Owner for review.

B. Button shall be hardwired.

C. Provide with a 1k/2k end of line (EoL) pre-built resistor pack. GRI (George Risk Industries, Inc.) 6644 series or approved equal.

D. Buttons within a single space may be wired in parallel and be programmed as a single zone.

E. Manufacturer:

1. Under desk – Honeywell Resideo 269R

2. Wall push type – STI-USA Stopper Station #SS2432LD-EN

a. Blue, flush cover, latching with key to unlock, Text = LOCKDOWN. Coordinate exact text to use with Owner prior to purchase. Provide with appropriate power supply connection for illumination.

3. Or approved equals

2.12 IP INTERCOM WITH INTEGRATED IP CAMERA

A. Exterior rated with vandal proof housing.

B. PoE powered.

C. (1) relays for device control and monitoring with tamper switch. The outputs shall be connected to the access control system headend for remote door unlock. Furnish with relay expansion modules as required.

D. Furnish and install an additional 18awg, 4-conductor cable from the access control headend to each intercom for door unlock integration.

E. Contain a built-in web server making video and configuration available to multiple clients in a standard operating system and browser environment using HTTP, without the need for additional software.

F. Be equipped with an integrated event functionality, which can be triggered by: video motion detection, button press, DTMF, audio, schedule, camera tampering, embedded third party applications, external input, audio detection, edge storage disruption detection, ect. The camera shall provide memory for pre & post alarm recordings. Event functions shall be configurable via the web interface.

G. Provide with appropriate surface mount backbox based on field conditions. Do not recess mount.

H. Integrated Intercom specifications:

1. SIP VoIP compliant
2. 2-way, full duplex audio
3. Built-in echo cancellation and noise reduction.

I. Integrated camera specifications:

1. Be designed to provide at least two simultaneous video streams in all resolutions, simultaneous including a SIP video stream, at a selectable range up to 25 frames per second (60Hz mode) using H.264 or MJPEG.
2. Support the following video resolutions: 2592x1944 (5mp).
3. 109 degrees horizontal by 81 degrees vertical field of view.
4. Integrated LED for illumination.
5. Provide with (1) Video Management System license per intercom to record the integrated camera.

J. Manufacturer and Model:

1. Avigilon Alta OP-VID-PRO-INT
2. Or approved equal

2.13 DISCONNECTING DOOR CORD

A. The Contractor shall furnish and install disconnecting door cords for all removable mullions.

B. Polarized quick disconnecting plug

C. Integrated stress relief chain

D. Surface mountable

E. Manufacturer:

1. Honeywell Resideo 69 Disconnecting Door Cord

PART 3 - EXECUTION

3.01 SYSTEM PROGRAMMING

A. The Contractor shall provide all programming necessary for a turnkey system.

B. Programming shall include but not limited to setting all required IP addressing, setting passwords, firmware upgrades, adding the devices into the software, partitioning, area/zone creation, device naming, mapping, cross system integration, schedules, basic card holder groups, access levels, etc.

C. The Contractor shall be responsible for temporary schedules, card holder groups, access levels, etc required to make a building functional for certificate of occupancy requirements or basic facility use.

3.02 SYSTEM MAPPING

A. The Contractor shall provide a satellite level screen shot map showing exterior devices. These maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly to the correct building then floor plan.

B. The maps shall have links to the other levels/sections as well as the global map.

C. Integrated cameras shall show their approximate field of view.

D. The floor plans shall include all access-controlled doors, controlled overhead doors and integrated devices.

E. Alarm icons for lockdown, panic and other alarms.

F. Contractor shall create non-card reader doors for non-card reader door unlock and status monitoring.

G. Contractor shall create map entities for intercoms.

3.03 SYSTEM PARTITIONING, ZONING AND NAMING

A. The Contractor shall program each facility to be in its own partition. Some facilities may require sub-partitions to control user access to certain areas. Each manufacturer may use different names for partitions, zones, areas, etc. Adapt as required.

B. All devices, inputs, outputs and other applicable software/hardware entities shall be named by the Contractor which includes naming at the administration/interface level in additional to the user facing interface.

C. As a basis to start, the following partition, zoning and naming shall be followed:

1. Partition: Building name

a. Zone 1: Building name and zone name such as exterior, 1st floor, etc.

i. Device 1: Building name and floor/zone name - Door # or device name

ii. Device 2: Building name and floor/zone name - Door # or device name

iii. Repeat as required

b. Zone 2: Building name and zone name such as 2nd floor, etc.

i. Device 1: Building name and floor/zone name - Door # or device name

ii. Device 2: Building name and floor/zone name - Door # or device name

iii. Repeat as required

c. Repeat zones as required.

2. Repeat Partitions as required.

D. The Owner shall have the final say. The Contractor shall schedule a coordination meeting with the Owner and Consultant to coordinate actual project structure and naming prior to starting any programming.

3.04 INSTALLATION PROCEDURES

A. The Contractor shall cable all controlled or monitored doors, intercoms, etc. and terminate this cable in the access control panels no less than 3 weeks prior to substantial completion regardless of the status of the field devices such as door hardware, card readers, intercoms, etc.

B. The Contractor shall program the access control system no less than 2 weeks prior to substantial completion so when field devices are installed and terminated, associated door hardware and full system functionality can be tested. Programming shall include all doors, associated inputs, outputs, and interoperability regardless of final field device status.

C. The Contractor shall perform final connections and testing onsite when field devices such as electrified door hardware has been installed.

3.05 ADA POWER ASSIST DOOR OPERATOR INTERFACE

A. Certain electric locking mechanisms with card access shall be connected (hardwired) to the ADA Power Assist Door Operator pushbutton. In this scenario, card reader shall be interfaced to the ADA Door Operator pushbutton to approve activation of door motor based on card authorization or pre-programmed security schedule.

B. Door motor/operator shall not be energized until authorized by the security system to prevent operation and eventual burn-out of the motor from hitting the button with the security system activated.

C. The door shall allow free egress via push paddle regardless if the door is in a locked or unlocked state.

D. The paddles and operators shall be tied through the access control system, so the actions appear in the device trees, are mappable, logged and can be scheduled or overridden.

1. Connect the exit paddle to an input on the access contro panel to trigger a door unlock when activated.

2. Connect an output from the access control system to the exit paddle input on the door operator to trigger the door operator to activate. Program a 1-second delay to prevent binding.

3. Connect the entry paddle to a relay that follow the lock status. When the lock is energized, the relay shall close allowing the entry paddle to activate the operator.

4. Connect the latch bolt monitor, if present, to the access control system to signal the door is manually dogged and to allow the entry paddle to operate.

E. Contractor shall provide all necessary cable, hardware, relays, I/O modules, interfaces, and system programming to support all necessary functionality.

F. All logic and programming shall be controlled through the access control system. Local logic boards, smart relays, etc. shall not be utilized.

3.06 DOOR RELEASE BUTTONS

A. Door release buttons shall be tied through the inputs of the access control system.

B. The button release shall be interfaced in a way that the actions appear in the device trees, are mappable, logged and can be scheduled or overridden.

C. Contractor shall provide all necessary cable, hardware, relays, I/O modules, interfaces, and system programming to support all necessary functionality.

3.07 INTERCOMS AND REMOTE INTERCOM RELEASE

A. The Contractor shall configure the intercoms and intercom master stations for point to point/multi-point communication with call rolling.

B. Remote intercom release relays shall be tied through the inputs of the access control system.

C. The intercom release shall be interfaced in a way that the actions appear in the device trees, are mappable, logged and can be scheduled or overridden.

D. Contractor shall provide all necessary cable, hardware, relays, I/O modules, interfaces, and system programming to support all necessary functionality.

3.08 LOCKDOWN/PANIC/DURESS BUTTONS

A. Lockdown/Panic/Duress buttons shall be tied through dedicated inputs of the access control system.

B. The buttons shall be interfaced in a way that the actions appear in the device trees, are mappable and logged.

C. When a panic/duress button is activated an event to action shall occur notifying client workstations. These alarms shall be activated on a map with a clear red flashing icon. Any associated or integrated cameras shall pop-up.

D. When activated all controlled doors shall enter a locked state, the coiling doors shall drop and the magnetic door hold opens shall release.

E. Additional actions may be required and shall be coordinated with the Owner and Consultant.

F. Contractor shall provide all necessary cable, hardware, relays, I/O modules, interfaces, and system programming to support all necessary functionality.

3.09 FIRE ALARM INTERFACE

A. Certain electric locking mechanisms shall be connected (hardwired) to the building fire alarm system for fail safe release upon any fire alarm. A single low voltage/low current normally closed dry contact from the fire alarm system shall be provided by others in each room with Security Control Panels. This contact shall open on any fire alarm condition.

B. The access control system shall provide an output to the fire alarm system to release mag hold opens on alarm.

C. The fire alarm system shall provide an output to the access control system to trigger various rules and actions in the access control system.

D. All doors equipped with mag locks shall be connected to a fire alarm relay to release on fire alarm.

E. All doors secured with a card reader in and out shall be connected to a fire alarm relay to release on fire alarm.

F. The Contractor shall provide all additional UL listed failsafe relays and power supplies as necessary to interface to this contact and unlock all of these doors.

G. The Contractor shall verify fail safe and fail secure locking requirements with the Architect, door hardware contractor/provider and the AHJ.

3.10 END OF LINE SUPERVISION

A. The Contractor shall furnish and install end-of-line resistors to provide end-of-line supervision on all access control input devices. This shall include but is not limited to door position switches, request to exit devices, door release buttons, and duress/panic buttons.

B. The Contractor shall furnish and install resistors as near to the field device as possible. Supervision resistance values shall be natively compatible with the associated control panel.

1. Mercury Security based installations shall utilize 1K resistors to provide a 1K / 2K ohm resistance values from associated inputs.

3.11 PASSWORDS

A. The Contractor shall coordinate a secure project password with the Owner and Consultant. This password shall be documented by the Contractor and used for all devices.

3.12 TESTING

A. Refer to Section 27 00 00 for additional requirements.

B. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer’s instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

C. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.13 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 4 hours of scheduled and dedicated training time in two (2) two (2) hour sessions for additional training or new functionality training.

2. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

3. Provide hands-on training with operational equipment.

4. Training shall be oriented to the specific system being installed under this contract as designed and specified.

5. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.14 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.15 INSTALLATION PRACTICES

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

F. Installation of locks on fire rated doors which require any modification or drilling of the door shall be done in accordance with the NFPA by a properly qualified and certified installer. The doors field WH-ETL labelling shall be properly updated.

3.16 COORDINATION

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with sequence of operation, rule creation and coordination as requested by Owner or Consultant.

3.17 AESTHETICS

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured level and plumb

E. All rack mount equipment shall be securely installed.

3.18 HARDWARE LAYOUT

A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.19 DEVICE CABLING/WIRING INSTALLATION PRACTICES

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant

shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

G. Cables shall not run above red iron joist.

H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

L. No splices shall be installed in any cable.

3.20 CABLE TERMINATION

A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.21 FIRE STOPPING

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

3.22 SYSTEM INSPECTION

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

3.23 LABELING

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

3.24 DOCUMENTATION

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.

2. Contractor shall provide a document including the following:

a. Door label/identifier

b. Location of each drop by orientation/permanent landmark in the room

c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.25 PRE-CHECK OUT

A. The Contractor shall demonstrate the following to Owner during system demonstration.

1. The card readers are fully installed and functional.

3.26 FINAL ACCEPTANCE

A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.

1. Owner training is complete.

2. Punch list items are complete.

3. As-built documentation is complete and submitted to Owner/Consultant.

3.27 FINAL PROCEDURES

A. Perform final procedures in accordance with section 27 60 00.

End of Section

SECTION 27 6400 – VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. This specification section covers the furnishing and installation of a new and complete, low-voltage, Video Management System (VMS).

B. The Districts seeks to migrate from their existing Avigilon Unity (ACC) on-premise video management system to a cloud managed SaaS solution.

C. Contractor shall furnish and install video surveillance hardware devices, mounting brackets, and other components of the system as required.

D. Contractor shall furnish and install all video management system related software to allow this system expansion. Software includes required licensing cameras, devices, workstations and required physical security system Integration.

E. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26.

F. Refer to Section 27 00 00 for additional project scope information.

1.02 PRECEDENCE

A. Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

1.03 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 51 00 – Distributed Communications Systems

I. Section 27 60 00 – Physical Security General Requirements

J. Section 27 62 00 – Electronic Access Control System

K. Section 27 66 00 – Intrusion Detection System

1.04 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.05 REFERENCE STANDARDS AND CODES

A. Refer to Section 27 00 00 for additional requirements.

1.06 QUALIFICATIONS

A. The video surveillance contractor, installer and programmer shall be an Avigilon Premier, Elite or Elite Plus dealer.

B. Refer to Section 27 00 00 for additional requirements.

1.07 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

B. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

C. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

D. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

E. Shop Drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

a. Floor Plans: Include device/equipment locations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

b. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

c. Wall Equipment Elevations: Include placement of all wall-mounted equipment, drawn to scale.

d. Server Storage Calculations: Include each camera type, quantity, resolution, storage parameters, and storage duration, with the calculations showing the resulting server size or space requirements on an existing server.

1.08 PRE-INSTALLATION PROCEDURES

A. For in-use, existing facilities or retrofit projects, the Contractor shall assign all applicable electronics IP addresses and secure passwords prior to being delivered to the project or installed. Confirm password with Owner and Consultant prior to setting them.

1.09 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.10 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.11 GENERAL SUMMARY

A. System shall include cloud managed IP cameras along with a cloud bridge to bring existing cameras into a cloud managed environment.

B. The Category 6 cabling to each new camera shall be provided by the structured cabling Contractor.

C. Patch cords for the IP cameras to the network switches shall be furnished by this Contractor and installed by the Contractor with participation by the Owner. Patch cords from the IP Camera to the data jack shall be furnished by this Contractor and installed by this Contractor.

D. System installation shall include, but not be limited to, installation, programming, and configuration of system components as well as all associated software upgrades, patches, and maintenance for the first year.

E. Contractor is responsible for meeting with Owner's representative at time of camera installation to verify exact placement and view of each camera to ensure coverage area is as intended.

1.12 MOUNTING AND INSTALLATION

A. Contractor shall provide the appropriate mounting hardware for all ceiling types and wall types where cameras shall be located. Plastic anchors are not allowed.

B. Wall mounted 180/360 degree or multi-sensor cameras shall be mounted horizontally on a wall arm, gooseneck, parapet, pendant or other similar method.

C. Exterior cameras shall be mounted on a wall arm/gooseneck.

D. Cameras mounted in droptile shall have a tile support bridge with a steel support cable connected to structure to prevent tile sagging, theft and vandalism. Utilizing toggle bolts or other screw in anchors is not allowed.

1.13 CODE AND STANDARD REQUIREMENTS

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and any other codes as required by the AHJ.

B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

PART 2 - PRODUCTS

2.01 VMS GENERAL REQUIREMENTS

A. The Contractor shall furnish a new cloud managed SaaS solution.

B. The solution shall integrate with the Owner's Active Directory for user management.

C. The Contractor shall furnish and install all required licensing and subscriptions.

D. The Contractor shall furnish a subscription term of 3-years as part of the base bid.

E. Manufacturer:

1. Base bid - Avigilon Alta

2.02 CAMERAS AND DEVICES

A. General:

1. All cameras and devices shall be time synced to the Owner's NTP server. Coordinate with the Owner to acquire the appropriate NTP address to use.

2. The contractor shall coordinate with the owner for IP addressing, network configuration, QoS and multicast network configuration.

3. The Contractor shall enable QoS on all cameras and intercoms for the video stream, audio stream, event/alarm data, management and metadata at the Owners request.

4. The Contractor shall select the appropriate mounting hardware for the situation.

5. All cameras shall be equipped with remote autofocus or autoback focus with the exception of fixed lens 180/360 degree cameras and encoded analog cameras.

6. Multi-sensor 180 and 360 cameras shall have each sensor optimally calibrated independently to the conditions.

7. All cameras shall be vandal proof and appropriate for the environment it is being installed in.

8. All cameras and devices shall have the latest VMS recommended firmware installed and all cameras of the same model shall have matching firmware versions. The Contractor shall provide all necessary firmware upgrades to keep the Owner on the latest version throughout the duration of the project. At the completion of the project the Owner shall have the option to receive a final firmware update the latest version before the project is paid in full.

9. The contractor shall coordinate with the owner for IP addressing, network configuration and multicast network configuration.
10. All cameras regardless of manufacturer/model shall have a consistent username and non-standard password set. This shall be documented and provided to the owner and consultant prior to inspections.
11. Cameras and devices shall not be manufactured by or contain components manufactured by a federal, state or local government proposed blacklisted or sanctioned manufacturer or a subsidiary of those manufacturers.
12. Cameras and devices shall not be an OEM or "white label" product. The camera or device shall be manufactured by the named manufacturer.
13. The cameras and devices firmware shall be developed and manufactured by the stated manufacturer and shall not be developed, written or OEM by a 3rd party.
14. The camera requirements below represent general performance criteria. Approved equals will have slight differences in specifications. The Owner and Consultant have complete discretion to reject approved equals that stray too far from the minimum requirements.
15. The Contractor shall furnish and install (1) video channel license for each camera including intercoms.
16. The Contractor shall furnish and install all appropriate boxes and mounting hardware. Mounting hardware noted is to provide a general description and not a complete mounting solution.
17. Cameras shall have a minimum of a 10-year warranty.

B. Camera Types 1

1. Native resolution of 3072x1728 pixels (5mp) at up to 30fps.
2. Minimum horizontal view angle 100°-45°
3. Remote focus and zoom.
4. Integrated 850nm IR.
5. Integrated edge analytics for classified object detection.
6. 30 days of storage
7. Manufacturer:
    a. Avigilon
        i. Interior/Exterior - DOME-W-5MP-30

C. Camera Type 2

1. Native resolution of 3840x2160 pixels (8mp/4K) at up to 24fps.
2. Minimum horizontal view angle 100°-45°
3. Remote focus and zoom.
4. Integrated 850nm IR.

5. Integrated edge analytics for classified object detection.
6. 30 days of storage
7. Manufacturer:
    a. Avigilon
        i. Interior/Exterior – DOME-W-4K-30

D. Camera Type 3

1. Native resolution of 3840x2160 pixels (8mp) per sensor at up to 17fps with analytics enabled on all sensors.
2. Minimum horizontal view angle 58°-106°
3. Remote focus
4. Optional IR ring, furnish and install with a 60W PoE++ injector.
5. Integrated edge analytics for classified object detection.
6. Provide pendant mount for exterior cameras and specifically noted interior cameras.
7. 30 days of storage.
8. Manufacturer:
    a. Avigilon - 32C-H5A-4MH-30

2.03 CLOUD BRIDGE

A. The Contractor shall furnish and install cloud bridges for up to (59) single sensor and (31) 4-sensor existing cameras.

B. Bridges shall be rack mount.

C. 30 days of retainage.

D. Manufacturer:

1. Avigilon Alta Cloud Connector A2100
2. Or approved equal

2.04 PROTECTIVE CAGES

A. The Contractor shall furnish and install protective wire cages over cameras in areas of high damage risk such as gyms or other locations noted.

B. 9 AWG white coated steel wire.

C. Furnish with mounting brackets and appropriate anchor.

D. Select appropriate size for location and type of device.

E. Cut cage as required to accommodate surface mounted conduit or field of view.

F. Manufacturer:

1. STI-USA or equivalent

    a. 7” x 7” x 7” wall/ceiling mount dome camera – STI-9729

2.05 CAMERA ANALYTICS

A. The Contractor shall install and configure any analytic plug-ins required on the servers and client workstations as required.

B. The Contractor shall enabled the analytics in the server settings on all cameras.

C. The Contractor shall furnish and install all licensing required to utilize the analytics and plug-ins.

2.06 ETHERNET WITH POWER OVER ETHERNET (POE) UTP SURGE SUPPRESSOR

A. The Contractor shall provide and install a surge protector for all exterior mounted cameras. Cameras that are not attached to the building or reach above the building roof line shall have a surge protector at the camera side and interior termination side.

B. There shall be a minimum of a 36” shielded patch cable from the surge protector to the device to allow for adequate clamping time.

C. When protector is mounted in interior, dry or weather sealed enclosure:

1. Shielded RJ-45 jacks and ground stud

    a. Bond to building steel or ground point with a minimum of a 14 AWG green solid copper cable keeping the distance as short as practical. Ground connection shall not exceed 5 ohms.

    b. Do not use shielded cable on the output.

2. Maximum supported data rate: 10,000Mb/s (10 Gigabit)

3. Supports IEEE 802.3af (PoE)

4. Max current rating of 30A per pair.

5. UL 497B listed

6. 110 punch down in and 110 punch down out.

    a. 110 punch down in and RJ-45 out may be used when output is connected directly to a switch or device port only when approved in specific situations.

7. Manufacturer:

    a. 110 to 110 - Ditek DTK-110C6APOE

    b. 110 to RJ-45 – Ditek DTK-110RJC6APOE

    c. Or approved equal

D. When protector is exposed to weather or moisture:

1. Shielded RJ-45 jacks and ground connection.

    a. Connected ground connection directly to ground.

b. Do not use shielded cable on the output.

2. Outdoor-rated NEMA 4X enclosure
3. Maximum supported data rate: 1,000Mb/s (1 Gigabit)
4. Supports IEEE 802.3af, 802.3at (PoE) and PoE+ up to 144 watts per port.
5. Max current rating of 20,000A per pair.
6. UL 497B listed
7. RG-45 in and RJ-45 out.
8. Provide with appropriate mounting kit.
9. Manufacturer:
   a. Ditek DTK-MRJPOEX
   b. Or approved equal

2.07 CABLING

A. Provide cabling per manufacturer's recommendations and code requirements for riser rated, plenum, and non-plenum cable types.

B. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.

C. UTP patch cables will be provided and installed by the Contractor in the IDF and provided by Contractor and installed by Contractor at the device.

PART 3 - EXECUTION

3.01 SYSTEM PROGRAMMING

A. The Contractor shall provide all programming necessary for a turnkey system.

B. Programming shall include setting all required IP addressing, setting passwords, firmware upgrades, adding the devices into the software, setting video streams, motion detection areas, recording settings, device naming, mapping, cross system integration, etc.

3.02 SYSTEM MAPPING

A. The Contractor shall provide a satellite level screen shot map showing exterior devices. These maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly to the correct building then floor plan.

B. The maps shall have links to the other levels/sections as well as the global map.

C. Cameras shall show their approximate field of view.

D. The floor plans shall include all integrated access-controlled doors, controlled overhead doors and integrated devices.

E. Contractor shall create map entities for intercom cameras for any intercom being recorded.

3.03 SYSTEM PARTITIONING, ZONING AND NAMING

A. The Contractor shall program each facility to be in its own partition. Some facilities may require sub-partitions to control user access to certain areas. Each manufacturer may use different names for partitions, zones, areas, etc. Adapt as required.

B. All devices, inputs, outputs and other applicable software/hardware entities shall be named by the Contractor.

C. As a basis to start, the following partition, zoning and naming shall be followed:

1. Partition: Building name

a. Zone 1: Building name and zone name such as exterior, 1st floor, etc.

i. Device 1: Building name and floor number– Camera or other device name

ii. Device 2: Building name and floor - Camera or other device name

iii. Repeat as required

b. Zone 2: Building name and zone name such as 2nd floor, etc.

i. Device 1: Building name and floor - Camera or other device name

ii. Device 2: Building name and floor - Camera or other device name

iii. Repeat as required

c. Repeat zones as required.

2. Repeat Partitions as required.

D. Camera Naming

1. All cameras shall be named based on Owner direction.

2. Multi-sensor cameras shall be named similar, and each sensor shall end with an identifier such as A, B, C and D so the images can be easily aligned in the client software by an end user.

E. The Owner shall have the final say. The Contractor shall schedule a coordination meeting with the Owner and Consultant to coordinate actual project structure and naming prior to starting any programming.

3.04 CAMERA POSITIONING PROCEDURES

A. The Contractor shall set an initial aim, zoom, field of view adjustment, rotation and focus immediately after the camera is installed following the design intent on the drawings, camera schedule and industry best practices.

B. The Contractor shall then take screen shots from the camera's web interface, label them based on the drawings device number and present them to the Owner and Consultant for an initial review and comment. The Contractor shall furnish a battery powered PoE injector to power up the camera to provide the initial aim/focus and screen shots and shall not rely on the Owner's network or PoE switches to be online or available.

C. The Contractor shall then fine tune the cameras aim and field of view based on the Owner's and Consultant's feedback then update the screen shots and present them back to the Owner and Consultant.

D. After the cameras aim, zoom, field of view adjustment and focus are finalized by the Consultant, the Contractor shall submit the screen shots to the Owner to obtain their final sign-off or additional comments. If any comments are received, the Contractor shall make the adjustments necessary and take updated screen shots and submit for re-approval.

E. The above will not happen at the same time and the Contractor shall plan on multiple trips to the project to make the adjustments.

F. The Contractor shall include the final screen shots as part of the as-builts.

3.05 COORDINATION

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with camera positioning/repositioning and coordination as requested by Owner or Consultant including post final signoff.

3.06 PASSWORDS

A. The Contractor shall coordinate a secure project password with the Owner and Consultant. This password shall be documented by the Contractor and used for all devices.

B. This secure password shall be set in the archiver default password field and each device in the video unit tab shall be set to use that set default.

3.07 TESTING

A. Refer to Section 27 00 00 for additional requirements.

B. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer's instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

C. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.08 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 4 hours of scheduled and dedicated training time in two (2) two (2) hour sessions for additional training and new features.

2. Contractor shall provide up to 2 hours of scheduled and dedicated training time for maintenance including lens and dome cleaning, focusing and positioning.

3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

4. Provide hands-on training with operational equipment.

5. Training shall be oriented to the specific system being installed under this contract as designed and specified.

6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.09 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.10 INSTALLATION PRACTICES

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and functional video surveillance system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

3.11 AESTHETICS

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured level and plumb

E. All rack mount equipment shall be securely installed.

3.12 HARDWARE LAYOUT

A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.13 VMS INSTALLATION PRACTICES

A. Verify that the manufacturer approved server hardware, OS meets the Owner's IT standards prior to ordering.

B. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.

C. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.14 DEVICE CABLING/WIRING INSTALLATION PRACTICES

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 05 00 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

G. Cables shall not run above red iron joist.

H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

L. No splices shall be installed in any cable.

3.15 CABLE TERMINATION

A. Termination hardware (patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.16 FIRE STOPPING

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

3.17 SYSTEM INSPECTION

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

C. Contactor shall verify with Project Representative the precise positioning of camera aim and shall make fine adjustments as requested.

3.18 LABELING

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

3.19 CAMERA INSTALLATION

A. Contractor shall field verify all camera locations and positioning with Owner prior to installation.

3.20 DOCUMENTATION

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.
2. Contractor shall provide a document including the following:
    a. Camera label/identifier
    b. Location of each drop by orientation/permanent landmark in the room
    c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.21 PRE-CHECKOUT

A. The Contractor shall demonstrate the following to Owner during system demonstration.

1. The cameras are fully installed and functional.
2. Camera adjustments are complete to the Owner's satisfaction including.
    a. Aim/Zoom
    b. Focus/Back Focus
    c. Masking Zones
    d. Motion Detection Zones
    e. Pre-Sets/Tours

3.22 FINAL ACCEPTANCE

A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.

1. Owner training is complete.
2. Punch list items are complete.
3. As-built documentation is complete and submitted to Owner/Consultant.

3.23 FINAL PROCEDURES

A. Perform final procedures in accordance with section 27 60 00.

End of Section

SECTION 27 6600 – INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. This specification section covers the furnishing and installation of a new and complete, low-voltage, Intrusion Detection System (IDS).

B. Contractor shall furnish and install intrusion detection hardware devices, mounting brackets, power supplies, switches, controls, consoles and other components of the system as required.

C. Provide necessary materials, hardware, software and cabling required to furnish a fully functional system as shown and specified.

D. Provide all required programming, testing and commissioning for a complete turn-key system.

E. The Contractor shall utilize the existing 3rd party UL listed monitoring service.

F. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26.

G. Refer to Section 27 00 00 for additional project scope information.

1.02 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 05 28 – Pathways for Technology Systems

E. Section 27 05 37 – Firestopping for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 51 00 – Distributed Communications Systems

I. Section 27 60 00 – Physical Security General Requirements

J. Section 27 62 00 – Electronic Access Control System

K. Section 27 64 00 – Video Surveillance System

1.03 DEFINITIONS

A. Refer to Section 27 00 00 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. National Electric Code, Article 760.

B. National Fire Alarm Code (NFPA 72).

C. Administrative Council for Terminal Attachments (ACTA):

1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.

D. American National Standards Institute (ANSI):

1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

E. Federal Communications Commission (FCC):

1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.

2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).

F. The National Institute of Standards and Technology of the United States of America (NIST):

1. Federal Information Processing Standards Publications 197 (FIPS 197) –Advanced Encryption Standard (AES).

G. Underwriters Laboratories, Inc. (UL):

1. UL 50 - Enclosures for Electrical Equipment.

2. UL 294 – Access Control System Units.

3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.

4. UL 609 - Local Burglar Alarm Units and Systems.

5. UL 985 - Household Fire Warning System Units.

6. UL 1023 - Household Burglar Alarm System Units.

7. UL 1076 – Proprietary Burglar Alarm Units and Systems

8. UL 1610 - Central Station Burglar-Alarm Units.

9. UL 60950-1 - Information Technology Equipment - Safety.

10. UL 636 – Hold up alarms

H. Refer to Section 27 00 00 for additional requirements.

1.05 QUALIFICATIONS

A. The Contractor shall be a DMP certified dealer.

B. Refer to Section 27 00 00 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. The following items shall be provided in a single, combined, comprehensive submittal package. Partial submittals will only be considered in special circumstances, such as getting early approval of long-lead-time items or products requiring additional coordination with other trades.

B. Equipment Schedules

1. Provide a complete schedule of significant materials for the project, with columns for the following items: Manufacturer, Part Number, Description, Quantity, and Unit Pricing.

C. Product Cut Sheets

1. Provide basic product data sheets (1-2 pages per product) for all products listed in the equipment schedule. Do not include longer documents such as installation manuals.

2. Identify (highlight, arrow, etc.) the actual version and part number of the product that will be utilized on the project. This applies to mounting hardware, cabling, connectors, software, and power distribution equipment in addition to major system components.

D. Shop Drawings

1. Pre-construction submittals are intended to document the details of installation. Exact copies of the Consultant's drawings and specifications are not acceptable as pre-construction shop drawings. The Consultant's drawings are intended to outline the functional requirements, but do not provide install-level detail.

2. Exact requirements will vary depending on the project scope. Provide the following elements where applicable:

3. Floor Plans: Include device/equipment locations, cable routes, maximum cable distance calculations, installation notes, and electrical coordination notes (specific conduit routing, etc.).

4. System Drawings: Include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification labels, connectors, adapters, intra/inter-rack power distribution, installation notes, and any other information required to convey the complete turnkey system design for an installer to complete the work.

5. Wall Equipment Elevations: Include placement of all wall-mounted equipment, drawn to scale.

6. Hardware Layouts: Include individual panel layouts, showing the number of controllers, sub-panels, and other associated devices per location.

7. Power Calculations: Include the anticipated power loads, number and type of power supplies including all power supply boards, number of 120VAC circuits required, battery backup including the quantities of batteries to meet requirements, PoE loads, fire alarm connection requirements, etc.

E. Refer to Section 27 00 00 for additional requirements.

1.07 PRE-INSTALLATION PROCEDURES

A. For in-use, existing facilities or retrofit projects, the Contractor shall assign all applicable electronics IP addresses, passwords and pre-build out all the enclosures including the interconnects within the enclosure prior to being delivered to the project or installed.

B. The Contractor shall cable all monitored doors, detectors, etc. and terminate this cable in the control panels no less than 3 weeks prior to substantial completion regardless of the status of the field devices.

C. The Contractor shall program the intrusion detection system no less than 2 weeks prior to substantial completion so when field devices are installed and terminated, the full system functionality can be tested. Programming shall include all monitored doors, associated inputs, outputs, and interoperability regardless of final field device status.

D. The Contractor shall perform final connections and testing onsite when field devices has been installed.

E. Refer to section 27 00 00 for additional requirements.

1.08 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

1.09 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.01 ALARM CONTROL PANEL

A. Shall be fully programmable multi-zone zone UL listed, Commercial intrusion alarm panel. Minimum features include:

1. 574 programmable points
2. 32 areas
3. 16 keypads
4. 10,000 users
5. Ground fault monitoring
6. Programmable for Fire, Intrusion, Access, Gas, and Supervisory devices.
7. Cloud enabled with mobile app and remote programming capabilities.

B. The panel shall include onboard 10/100 full duplex Ethernet connectivity.

1. Provide with secondary 10/100 full duplex ethernet expansion module where required for integration to 3rd party systems or as otherwise required.

C. Provide with all appropriate modules as required for a complete system.

D. Requires 16.5 VAC, provide with appropriate power supply connection as specified within this section. Pluggable transformers “wall warts” are not allowed.

E. UL 365, 609, 636, 1610, 1635 and 1076 listed.

F. Integrated battery charger.

G. Expansion slots for onboard cellular or digital dialer primary or backup communication.

H. All controllers and expansion modules shall have the latest recommended firmware installed and shall have matching firmware versions. The Contractor shall provide all necessary firmware upgrades to keep the Owner on the latest version throughout the duration of the project. At the completion of the project the Owner shall have the option to receive a final firmware update the latest version before the project is paid in full.

I. Manufacturer:

1. DMP XR550

2.02 KEYPADS, TOUCH SCREEN

A. The Contractor shall furnish and install (1) touch screen keypad next to, or on the door of the main intrusion detection panel enclosure in addition to other locations noted.

B. Color backlit 7” touch screen.

C. UL Listed.

D. Requires 12 VDC @ 300 mA.

E. Manufacturer:

1. DMP 8860

2.03 PROTECTIVE ENCLOSURE

A. The Contractor shall furnish and install an enclosure over the touch panel/keypad where required.

B. Clear polycarbonate

C. Open back

D. Hinged cover

E. Non-vented

F. Thumb turn or keyed lock

G. Furnish with appropriate mounting hardware

H. Furnish with conduit entry kit when surface mounted conduit is utilized.

I. Adjust size and type as required for the installation scenario

J. Manufacturer:

1. STI-USA or equivalent
    a. Thumb turn – STI-7510C
    b. Keyed lock – STI-7511C

2.04 INPUT EXPANSION MODULE

A. All devices shall be homerun

B. Furnish and install 8 or 16 input expansion modules as required.

C. Manufacturer:

1. DMP

2.05 OUTPUT EXPANSION MODULE

A. Furnish as required

B. Manufacturer:

1. DMP

2.06 BATTERIES AND BACKUP

A. The Contractor shall provide a minimum of (2) 12V, 7ah, sealed Absorbent Glass Mat (AGM) style batteries with F style terminals per power supply and (1) per control panel. Provide additional as required based on calculated power load.

B. Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 8-hours.

C. Manufacturer:

1. Interstate Power Patrol FAS1075
2. Power Sonic PS-1270
3. Or approved equal

2.07 END OF LINE SUPERVISION

A. All monitored intrusion detection devices shall include EoL monitoring.

2.08 DOOR CONTACTS/DOOR POSITION SWITCHES (DC)

A. The Security Contractor shall be responsible for the connection of all door position devices to the intrusion detection system. Door position devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements.

B. Sealed and potted magnetic reed switch in contact housing.

C. Provide DPDT for applications with multiple security systems (Access Control/Intrusion Detection or PLC) utilizing a single door contact.

D. Door contacts shall be appropriately sized for any established holes within door frames.

E. Parts provided are basis of design. Determination of final part number is the responsibility of Contractor.

F. Provide color that matches door as close as possible.

G. Provide recessed switch whenever possible.

H. Armored whip for surface mount contacts.

I. Provide GRI (George Risk Industries, Inc.) 180 Series for recessed applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

J. Provide GRI (George Risk Industries, Inc.) 4400 series for surface mount applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

K. Provide GRI (George Risk Industries, Inc.) MC-180 Series for hollow top channel applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

L. Provide GRI (George Risk Industries, Inc.) 4532 Series for overhead door applications.

1. Magnasphere
2. Nascom
3. Or approved equal.

2.09 MOTION DETECTORS

A. The motion detector shall be a dual-technology, IR and radar device.

B. Reduces false alarms by sensing both heat, physical motion and compensation algorithms.

C. Wide angle: 60’ x 80’ standard coverage, selectable 25’ x 33’ coverage.

D. Long range: 8.5’ x 100’ standard coverage, selectable 3.3’ x 25’ coverage.

E. Power requirements: 9-15 VDC

F. Provide with appropriate mounting hardware.

G. White.

H. Manufacturer:

1. DMP FLX-S-DT

2. Or approved equal

2.10 360 MOTION DETECTORS

A. 360 Degree coverage: 40’ diameter.

B. Power requirements: 9-15 VDC

C. Maximum current draw at 12VDC.

D. Can be mounted between 8’-12’ with no adjustments.

E. White.

F. Manufacturer:

1. DMP FX-360

2. Or approved equal

2.11 PROTECTIVE CAGES

A. The Contractor shall furnish and install protective wire cages over devices such as motion detectors in areas of high damage risk such as gyms or other locations noted.

B. 9 AWG white coated steel wire.

C. Furnish with mounting brackets and appropriate anchor.

D. Select appropriate size for location and type of device.

E. Manufacturer:

1. STI-USA or equivalent

a. Corner mount – STI-9619

b. Wall mount – STI-9621

c. Ceiling 360 detector mount – STI-9602

2.12 INTRUSION DETECTION PANEL ENCLOSURES

A. Provide a power supply/chargers and sub-assemblies to power various intrusion controller boards, detectors, audible/visual alarms and other access control or security system components. The Contractor shall select the appropriate enclosure, power supply and sub-assemblies for each application.

B. Enclosures

1. Shall be capable of accommodating power supplies, sub-assemblies and other manufactures boards when required.

2. Wall mountable.

3. Include a cam-lock and tamper switch.

4. Provide with main backplane and door backplane.

5. Provide with power rocker switches between each transformer and the board.
6. Manufacturer:
    a. Altronix Trove2 with door backplane or as appropriate for intrusion panel manufacturer.
    b. Or approved equal

C. Sub-Assemblies

1. The Contractor shall provide all sub-assemblies to meet the project requirements.
2. Access Control Module
    a. Independently controlled fused protected outputs:
        i. Fail-Safe and/or Fail-Secure power outputs.
        ii. Dry form “C” 5 amp rated relay outputs (fused).
        iii. Any combination of the above
3. Access Control System trigger inputs:
    a. Normally open (NO) inputs.
    b. Open collector sink inputs.
    c. Any combination of the above.
4. Multi-Output Power Distribution Module
    a. Single input distributed over eight (8) or sixteen (16) outputs.
    b. Fused protected outputs.
    c. Output terminals shall accommodate up to 12AWG wires.
5. Multi-Output Power Distribution Module with Dual Inputs
    a. Two (2) inputs distributed over eight (8) outputs.
    b. Outputs shall be configurable by input.
    c. Fused protected outputs.
    d. Output terminals shall accommodate up to 12AWG wires.
6. Power supplies and sub-assemblies shall be manufactured by Altronix or approved equal:
    a. Altronix ACMS8 – Dual input, eight (8) output, fused Access Control Module (UL listed Sub-assembly).
    b. Altronix PDS8 - Dual input, eight (8) output, fused power distribution module (UL listed Sub-assembly).
    c. Altronix PD16W – Selectable dual input, sixteen (16) output, fused power distribution module (UL listed Sub-assembly).
    d. Altronix RSB2 – Rocker switches with mounting bracket.

2.13 POWER TRANSFORMERS

A. The Contractor shall provide all required transformers and power supplies.

B. The power supplies shall be hardwired. Pluggable “wall wart” transformers are forbidden.

C. Provide with enclosure as required.

D. 115 VAC input.

E. Provide a 16 VAC output @ 6.25A transformer to power the control panel.

F. Provide a 18 VAC output @ 16.7A transformer to power the power supply module.

G. Connect transformers outputs through rocker switches to control on/off power to the panels for service.

H. Manufacturer:

1. Altronix
    a. 16VAC Transformer - T16100C
        i. Mount above Altronix Trove 2 enclosure in the included Altronix CAB4 enclosure.
2. Or approved equal

2.14 CABLES

A. Provide cabling per manufacturer’s recommendations and code requirements for riser rated, plenum, and non-plenum cable types.

B. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.

C. UTP patch cables will be provided and installed by the Contractor in the IDF and provided and installed by Contractor at the control panels.

D. Door Contacts, Panic/Duress Buttons, mechanical sensors, etc.: 18-gauge, four-conductor, unshielded, stranded cable shall be provided for all door contacts. The cable shall be white in color and plenum rated.

E. Motion Detectors: 18-gauge, four-conductor, shielded, stranded cable shall be provided for all motion detectors. The cable shall be white in color and plenum rated.

F. Keypads: 18-guage, four-conductor, non-shielded, non-twisted, stranded cable shall be provided for keypads. The cable shall be white in color and plenum rated. Cable impedance shall not exceed 100 ohms.

G. Follow manufacturer’s recommendations for all systems cabling.

PART 3 - EXECUTION

3.01 SYSTEM PROGRAMMING

A. The Contractor shall set the Ethernet communications to TCP/IP.

B. The Contractor shall enable 128-bit AES encryption when required.

C. The Contractor shall program all inputs EoL resistance values. All inputs shall have an EoL unless specifically submitted on and approved by the Consultant.

D. The Contractor shall configure mail server SMTP settings and port. The Contractor shall coordinate with the Owner on email accounts to be added.

E. Programming system configuration parameters (hardware and software, zone/circuit numbers, communication parameters).

F. Programming operational parameters such as opening/closing reports and windows, system response text displays of events, activation of relays that drive auxiliary devices, and identifying types of zones/loops.

G. Programming passcodes according to the authorities and functions defined by the Owner.

H. The Contractor shall program all compliance and panel wide parameters including onboard and add-on module ethernet parameters, Cloud Remote Connect settings, report routing, power supervision, RPS parameters, miscellaneous settings, etc.

I. The Contractor shall set all point, point profiles, area and debounce times according to the requirements, best practices and Owner requirements. The Contractor shall create custom point profiles as required for desired functionality.

J. The Contractor shall set all Area necessary parameters including force arm/bypass, exit delay time, restart time, area type, part on, exit/entry delay warning, area re-arm time, etc.

K. The Contractor shall assist with entering users, authority levels and PINs.

L. Other system programming tasks required by the owner. These additional programming requirements shall be coordinated between the owner and the contractor.

M. Operational Testing: The contractor shall perform thorough operational testing, walk testing, and verify that all system components are fully operational.

N. Hard-copy System Printout: The contractor shall submit a hard-copy system printout of all components tested and certify 100 percent operation indicating all devices/panels/units have passed the test criteria set forth by the manufacturer.

O. Acceptance Test Plan Form: An acceptance test plan form shall be prepared/provided by the contractor prior to the acceptance walk-through.

P. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the contractor (pass/fail), and an empty column for recording findings during the walk-through.

3.02 SYSTEM PARTITIONING, ZONING AND NAMING

A. The Contractor shall program each facility to be in its own partition. Some facilities may require sub-partitions to allow arming and disarming of specific areas. Each manufacturer may use different names for partitions, zones, areas, etc. Adapt as required.

B. All devices, inputs, outputs and other applicable software/hardware entities shall be named by the Contractor.

C. As a basis to start, the following partition, zoning and naming shall be followed:

1. Partition: Building name

a. Zone 1: Building name and zone name such as 1st floor, gym, auditorium, etc.

i. Device 1: Building name and floor number – detector or device name

ii. Device 2: Building name and floor - detector or device name

iii. Repeat as required

b. Zone 2: Building name and zone name such as 2nd floor, etc.

i. Device 1: Building name and floor - detector or device name

ii. Device 2: Building name and floor - detector or device name

iii. Repeat as required

c. Repeat zones as required.

2. Repeat Partitions as required.

D. Device Naming

1. All devices shall be named based on Owner direction.

E. The Owner shall have the final say. The Contractor shall schedule a coordination meeting with the Owner and Consultant to coordinate actual project structure and naming prior to starting any programming.

3.03 MONITORING SERVICE AND COMMUNICATIONS INTEGRATION

A. The Contractor shall program the intrusion panels to communicate to the Owner's preferred monitoring service which may be their own internal monitoring or an external service.

B. The Contractor shall program all applicable route groups for primary and backup using the appropriate communication formats accepted by the monitoring service. Radionics Modem 4 is preferred when possible. Set AES encryption where required.

3.04 MOTION DETECTOR INSTALLATION REQUIREMENTS

A. Install between 7' and 10' above finished floor unless manufacturer's specifications allow otherwise.

B. Point away from outside traffic. Microwave energy passes through non-metallic walls and can detect outside of the space.

C. Position 360 detectors farther from exterior walls.

D. Point or position away from direct and reflected sunlight.

E. Point or position away from glass or other objects that rapidly change temperatures.

F. Point or position away from moving or rotating objects such as fans.

G. Mount the detector on a solid and vibration free surface.

H. Avoid mounting the detector within 1 ft (minimum) of any fluorescent light fixture.

I. Long range, narrow angle detectors should be mounted in the center of hallways when possible.

J. Wide angle detectors should be mounted in corners of the areas being covered when possible.

K. Wide angle detectors mounted in spaces smaller than 25’ x 33’ should have the DIP switch set to reduce the PIR coverage and radar potentiometer turned down.

L. Long range, narrow angle detectors mounted in corridors shorten than 3.3’ x 25’ should have the DIP switch set to reduce PIR coverage and radar potentiometer turned down.

M. Detectors should have the down lens enabled unless specifically noted otherwise.

3.05 END OF LINE SUPERVISION

A. The Contractor shall furnish and install end-of-line resistors to provide end-of-line supervision on all intrusion input devices. This shall include but is not limited to door position switches, motion detectors, glass break detectors, duress/panic buttons and all other inputs being monitored.

B. The Contractor shall furnish and install resistors as near to the field device as possible. Supervision resistance values shall be natively compatible with the associated control panel.

3.06 PASSWORDS

A. The Contractor shall coordinate a secure project password with the Owner and Consultant. This password shall be documented by the Contractor and used for all devices.

3.07 SYSTEM GROUNDING

A. The Contractor shall ground all components of the system to the telecommunications grounding system and ground fault detection shall be enabled according to UL requirements.

3.08 TESTING

A. Refer to Section 27 00 00 for additional requirements.

3.09 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

3.10 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

B. Contractor shall guarantee all materials, equipment, etc., for one (1) year from date of substantial completion of work. This guarantee shall include labor, material, and travel time.

C. All Intrusion Alarm systems, materials, and labor shall be under warranty for 1 year from date of final acceptance.

3.11 GENERAL

A. Prerequisites

1. The Contractor shall maintain a competent (single point of contact) project supervisor, along with competent technical personnel acceptable to the Owner and Consultant, during the entire installation process. Best efforts shall be made to avoid change of the project supervision during the project without prior written approval from the Owner and/or Consultant.

2. The Contractor installing any equipment/devices shall be responsible for providing all interconnecting cables to and/or between same equipment that may be required to make equipment fully operational.

B. Requirements and Responsibilities

1. The Contractor shall provide, furnish, deliver, transport, erect, install, configure, and connect completely all of the material and equipment described herein or depicted on project drawings. The Contractor shall supply all other incidental material required, such as interconnecting cables, to make the work complete, and to install all systems in a turnkey operating condition.

2. Perform this work in accordance with acknowledged industry and professional standards and practices, existing build conditions, and as specified herein. Proved and install all materials, devices, components, and equipment for complete, operational systems.

3. Coordinate all efforts and verify field conditions with those of related trades. In the event of any conflicts, delays or improper preparatory work by others, notify the Owner or Owner's Consultant: The Owner and Owner's Consultant's decision will be binding.

3.12 INSTALLATION PRACTICES

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner and Owner's Consultant reserve the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Contractor shall exercise care during installation - damage to cables or equipment will not be accepted. The Contractor shall remove any damaged cabling or equipment and replace with new.

C. Contractor is responsible for providing a complete and functional intrusion alarm system.

D. Contractor shall provide low voltage power and control lines to and from power supplies, remotely controlled equipment, and other devices, even though not explicitly indicated on drawings or listed in equipment tables.

E. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

F. The Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

G. The Contractor shall provide rack shelves or rack mounting ears for any equipment that is not rack mountable. All equipment installed using shelves shall be fastened to the rack shelf.

H. Install plates as required on back boxes where they exist. Provide cut-in back boxes where boxes do not exist.

I. Install surface mounted cable raceway systems that match the surface color and/or the other surface mounted raceways, where cables cannot run within fishable walls.

J. The Contractor installing any RF devices shall be aware that RF devices may cause interference to equipment and shall take whatever precautions necessary to avoid causing interference.

K. The Owner will provide programming information needed to help Contractor with configuration of system. The Contractor shall have the responsibility to program the system, assure proper communications between controlling points and any monitoring companies, and to adjust any system or device causing false alarm conditions.

L. Consideration shall be given not only to operation efficiency, but also to overall aesthetic factors.

3.13 COORDINATION

A. Contractor shall provide up to 4 hours (up to two, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with sequence of operation, zone coordination, rule creation and coordination as requested by Owner or Consultant.

3.14 TRAINING

A. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 1 hours of scheduled and dedicated training time in two (2) thirty (30) minutes sessions for system arming and disarming per site.

2. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

3. Provide hands-on training with operational equipment.

4. Training shall be oriented to the specific system being installed under this contract as designed and specified.

5. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.15 SUPPORT

A. The Contractor shall make available technical resources, as deemed necessary by the Owner, for database integration projects.

3.16 AESTHETICS

A. All cables terminating at the panel frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. A horizontal and vertical alignment for all mounting hardware shall be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured and level.

3.17 HARDWARE LAYOUT

A. Hardware positioning and layout shall be according to project drawings.

3.18 DEVICE CABLING/WIRING INSTALLATION PRACTICES

A. Contractor shall coordinate with the Electrical Contractor their requirements for conduits and proper AC power to service all equipment installed by Contractor, in locations where power is not available.

B. Contractor shall provide for proper ground system to all equipment.

C. Each cable group that can cause interference to another group shall be separated by sufficient distance so as not to cause signal contamination or interference.

D. All external wire and cables shall be supported at least every five feet from the structure, or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables.

E. All cables, regardless of length, shall be marked with indelible color-coded labels within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified. Labels shall be directly hot stamped or factory stamped, closed sleeve method. Adhesive strip labels may only be used if protected by transparent heat-shrink tubing. There shall be no unmarked cables at any place in any part of any system. Marking codes used on cables shall correspond and be shown clearly on as-built drawings.

F. Each cable shall be marked at all cable ends with a standard nomenclature (Device, #, closet letter).

G. All cables shall be separated into like groups, according to signal or power levels, and routed separately to eliminate signal contamination and crosstalk - this includes both inside and outside of equipment racks.

H. All cables shall have 6-foot service loops neatly coiled in accessible ceiling. During initial cable rough-in, the Contractor shall have sufficient slack to route anywhere within Telecommunications Room. Coordinate exact panel and power supply mounting locations with Electrical Contractor.

I. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Velcro straps shall be installed snugly without deforming cable insulation. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost.

J. Cable Ties shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

K. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

L. Cables shall not run above red iron joist.

M. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

N. Contractor shall notify Owner or Owner's Consultant immediately if obstruction or hazard is discovered in a pathway provided by others.

O. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

P. No splices shall be installed in any cable.

Q. No security device cabling shall have an accessible disconnect outside of a secured equipment room or within a backbox.

R. Any exterior exposed will be contained in waterproof conduit with the appropriate waterproof fittings.

S. All cables are to run at right angles to the structure, placed above the ceiling in halls and corridors.

T. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors and ceilings, assuming any applicable codes and good engineering practice allows and suggests.

U. All cabling systems installed in public areas shall be installed within walls, ceiling or floors or within surface wiring pathways as dictated by codes and good engineering practices.

V. Contractor shall notify Owner or Owner's Consultant immediately if obstruction or hazard to cable paths are discovered and seek corrective actions

W. The cables shall be supported by properly insulated wire support hangers, bridal rings, "D" rings, ladder cable tray, or inner duct as may be necessary to support cables.

X. Contractor shall seal any cable penetrations they may use or make where the penetration is part of a firewall or acoustic barrier.

3.19 EQUIPMENT CABINET WIRE AND CABLE INSTALLATION

A. All power cables, control cables, and high level cables shall be grouped to one side of the equipment rack while low level cables grouped to the other side.

B. All equipment rack wiring and cabling shall be neatly laced, and ends dressed with heat shrink tubing, and all cables shall have service loops between the horizontal tie bar and the connection to equipment. Rack cabling shall be adequately supported with tie wraps or Velcro wire wraps, and horizontal support bars to rack frame as it enters or exits the front or back of equipment.

C. All equipment rack wiring and cabling shall be neatly dressed.

D. Rack cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame.

3.20 CONNECTORS/CONNECTIONS

A. Moisture Resistance: All connectors shall be crimped or applied in such a way as to prevent moisture from entering the connector or cable.

B. Preparation: Cables shall be carefully prepared and connectors installed as directed by the manufacturer. Proper stripping devices and crimping tools shall be used.

C. Terminations: Connectors shall be carefully fitted to mating devices on equipment to avoid damage to mating contacts, inserts, or bodies. Specialized terminations shall be made in a neat and secure manner, suited to the service of the wire, and as directed by the manufacturer. In all cases, where the manufacturer specifies the terminations, those terminations shall be used.

D. Termination Testing: The strength of the termination shall be tested by manually pulling on the connector and cable. Any terminations that exhibit movement, loose cable, or insecure connections shall be re-terminated.

3.21 SPECIAL TECHNIQUES

A. Waterproofing: Contractor shall be responsible for creating a waterproof seal in and around any openings the Contractor creates, or are created by others for use by Contractor, that enter or exist in a structure to the outside environment.

3.22 FIRE STOPPING

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for the telecommunication Contractor to pass cable through, shall be the responsibility of the security Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by, or for Contractor, and left unused, shall be sealed up as part of this work by the telecommunication Contractor.

3.23 TEST REQUIREMENTS FOR DEVICE CABLING

A. Contractor shall perform continuity tests to ensure cables are free of shorts within the pairs, and shall verify cables for continuity, pair validity and polarity, and conductor position.

3.24 SYSTEM TESTING PROCEDURES

A. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer’s instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

B. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.25 SYSTEM INSPECTION

A. Contractor shall coordinate with Consultant for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

C. Contractor shall demonstrate to Consultant the functionality of the system, including the selection of various display modes and accessing system functions.

D. Contractor shall verify with Consultant the precise positioning of all devices and shall make fine adjustments as requested.

3.26 LABELING

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on project as-built drawings.

B. Contractor shall label both ends of the cable within four (4) inches of the termination with the same label identifier. These will be machine printed, Brady (or equivalent) labels.

C. Panels shall have labels showing cable numbers and far end locations for each cable terminated in the cabinet.

3.27 DOCUMENTATION

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval. All documentation shall become the property of the Owner.

B. Documentation shall include the items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.

2. Contractor shall provide a document including the following:

a. Device label/identifier

b. Location of each device by room or corridor number

C. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

D. Consultant will provide floor plans in paper and electronic formats (".dwg," AutoCAD and ".dxf") on which as-built construction information can be added. The Contractor shall modify these documents accordingly to denote as-built information as defined above and then return the documents to the Owner.

3.28 FINAL ACCEPTANCE

A. The Contractor shall demonstrate the following before final approval.

1. Owner training is complete.

2. Punch list items are complete.

3. As-built documentation is complete and submitted to Owner/Consultant.

3.29 CLOSEOUT PROCEDURES

A. Closeout Submittals: Contractor shall provide closeout documentation to the Consultant. The Consultant shall receive the closeout submittals no less than 72 hours prior to the scheduled inspection time.

B. Inspection: Contractor shall be present for the inspection by the Consultant. Contractor shall supply all testing equipment needed to verify compliance with the specifications.

C. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet written system specifications, and/or unacceptable to the Consultant, shall be documented by the Consultant and provided to Contractor to rectify.

D. Re-Inspection: If a re-inspection is necessary, the costs of the Consultant's additional travel, hours, and expenses may be deducted by the Owner from the contract amount due Contractor.

E. Punch List Approval: The punch list shall be considered complete only after having been signed by the Owner and Consultant.

3.30 CLEANING

A. Prior to system final turnover to Owner:

1. Remove all dirt and debris from equipment racks and equipment rooms.

2. Clean all equipment filters, vents, and fans.

3. Clean all enclosures and back box interiors thoroughly before installing plates, panels, or covers.

End of Section

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SECTION 28 05 00

COMMON WORK RESULTS FOR SAFETY AND SECURITY

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Work consists of furnishing labor, materials, equipment, and services required for the complete installation of work shown in the Contract Documents and as specified in Division 28.

B. Include all parts and labor which are incidental and necessary for a complete and operable installation even though not specifically mentioned in the Contract Documents. Such items include nuts, bolts, anchors, brackets, sleeves, offsets in conduit, fittings, relays, etc.

C. Some equipment and materials provided under Division 26 may require composite work crews because of trade jurisdiction. Where this occurs, include in the bid this portion of the composite crew labor costs. It is the Contractor's responsibility to review Division 26 Contract Documents to determine where these composite crews are required.

D. Obtain all temporary and permanent permits and licenses required in connection with this Division's work. Pay all fees and expenses required for such permits and licenses.

E. Request inspections as required by regulating agencies and/or regulations. Contractor shall include all charges for inspections by regulating agencies of installations of plans specifications in the Base Bid price.

F. Include State and Local sales taxes in the bid. Keep accurate records of these taxes and furnish such records to the Owner Representative upon request.

G. Provide the Owner Representative with a certificate of final inspection and approval by enforcement authorities.

H. The fire alarm system shall be designed and built by the Contractor.

1.2 RELATED SECTIONS

A. Divisions 0 and 1 apply to all work of Division 28 and are an integral part of this Section. Where the conditions specified are at variance with other Divisions, Section 28 05 00 takes precedence. Section 28 05 00 specifies conditions, procedures, equipment and material particular to the electrical work and applies to all electrical work of the Contract Documents.

B. Division 0 and 1 and 28 05 00 and all Addenda form a part of and apply to all contracts or sub-contracts relating to Division 28 work. Copy these documents to all Sub-contractors receiving other Sections of Division 28.

C. Where a Specification Section refers to other Sections under the Article on Related Sections, this is done for Contractor's convenience only. It shall in no way relieve the Contractor of responsibilities stated in other Sections of the Specifications, even though these Sections are not specifically referenced. The Contractor is responsible for all information contained in this Division's Specifications as well as for information contained in all other Divisions.

1.3 REFERENCES

A. Meet or exceed all current applicable codes, ordinances, and regulations for all installations. Promptly notify the Engineer, in writing, if the contract documents appear to conflict with governing codes and regulations. Contractor assumes all responsibility and costs for correcting non-complying work installed without notifying the Engineer.

B. Higher quality of workmanship and materials indicated in the Contract Documents takes precedence over that allowed in referenced codes and standards.

C. Perform all work in compliance with the currently adopted version of the following codes and standards for this project:
   1. National Electric Code
   2. State and Local Electrical Codes
   3. International Building Code
   4. International Fire Code
   5. International Mechanical Code
   6. State and Local Building Codes and Ordinances
   7. State Industrial Commission Regulations
   8. State and Local Fire Codes and Regulations
   9. State and Local Mechanical Codes
   10. State Elevator Code
   11. Occupational Safety and Health Administration Regulations
   12. Americans with Disabilities Act
   13. Uniform Federal Accessibility Standards
   14. State Board of Health
   15. NFPA 101 Life Safety Code
   16. State Energy Code

D. Use the Standard where referenced in the specifications by the following abbreviations:
   1. AIA: American Insurance Association
   2. AIA: American Institute of Architects
   3. ANSI: American National Standards Institute
   4. ASTM: American Society of Testing and Materials
   5. EPA: Environmental Protection Agency
   6. FM: Factory Mutual Insurance Association
   7. IEEE: Institute of Electrical and Electronic Engineers
   8. IES: Illuminating Engineering Society of North America
   9. ICEA: International Cable Engineers Association
   10. NBS: National Bureau of Standards
   11. NEMA: National Electrical Manufacturers Association
   12. NFPA: National Fire Protection Association
   13. NSC: National Safety Council
   14. UL: Underwriter's Laboratories

1.4 DEFINITIONS

A. The terms defined below apply to all work included in Division 28.

1. The work –The term ‘Work’ means the construction and services required by the Contract Documents whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. The Work may constitute the whole or a part of the Project.
2. Furnish – to obtain in new condition ready for installation into the work.
3. Install – to store, set in place, connect and place into operation into the work.
4. Provide – to furnish and install.
5. Connect – to bring service to the equipment and make final attachment including necessary switches, outlets, boxes, terminations, etc.
6. Conduit – includes in addition to conduit, all fittings, pull boxes, hangers and other supports and accessories related to such conduit.
7. Concealed – hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, in crawl spaces or buried.
8. Exposed: not installed underground nor concealed as defined above.
9. Building structure or building structural members - consists of steel columns, steel beams, steel joists (top chord and at panel points), concrete walls and concrete block walls. Metal decking, joist bridging and bottom chords of bar joists shall not be construed as building structure nor as a building structural member for the purpose of support.

B. The drawing and specifications constitute the Contract Documents. Any item noted in the specification or shown on the drawings is included in the Contract Documents.

C. All electrical details and drawings are diagrammatic, unless specifically noted. Field verify all dimensions and notify the Engineer of any conflicts of discrepancies, in writing, prior to installation.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Initiate, maintain and supervise all safety precautions required with this work in accordance with the regulations of the Occupational Safety and Health Administration (OSHA) and other governing agencies.

B. Environmental Requirements:
1. Do not remove or disturb any asbestos containing materials from the project. Immediately stop work and notify the Owner Representative if asbestos containing materials are suspected.
2. Do not dispose of any PCB containing materials. Disposal of all PCB containing materials will be the responsibility of the Owner Representative.

C. Provide new, first quality material for all products specified. Do not reuse materials unless indicated or approved by the Engineer.

D. Comply with the NEC as applicable to the construction and installation of equipment specified in this section.

E. Provide equipment specified in this section that has been listed and labeled by a nationally recognized testing laboratory.

F. Comply with ANSI as applicable to equipment specified in this section.

G. Comply with NEMA as applicable to equipment specified in this section.

1.6 PROJECT/SITE CONDITIONS

A. Site Inspections:
   1. Before submitting a proposal on the work contemplated, examine the site of the proposed work and become thoroughly familiar with existing conditions and limitations. No extra compensation will be allowed because of misunderstanding as to the amount of work involved nor bidders lack of knowledge of existing conditions which could have been discovered or reasonably anticipated prior to bidding.
   2. Conduits, pipes, ducts, lights, devices, speakers, etc., shown on the drawings as existing have been based on existing plans and may not be installed as originally shown. It is the Contractor's responsibility to visit the site and make exact determination of the existence, location and condition of such facilities prior to submitting a bid.

B. Correlation of Work:
   1. Consult the drawings and specifications of all other Divisions for correlating information and layout work so that it will coordinate with other trades. Verify dimensions and conditions (i.e., finished ceiling heights, footing and foundation elevations, beam depths, etc.) with the Architectural and Structural drawings. Notify the Architect/Engineer of any conflicts that cannot be resolved, in the field, by affected trades. Replacement of work due to lack of coordination and failure to verify existing conditions will be completed at no cost to the Owner Representative.
   2. Install all conduit, cable tray, equipment, etc. allowing proper code and maintenance clearances and avoiding blocking passageways and access panels.
   3. Where work must be replaced due to the failure of the Contractor to verify the conditions existing on the job, such replacement must be accomplished at no cost to the Owner Representative. This applies to shop fabricated work as well as to work fabricated in place.
   4. Throughout the course of the work, minor changes and adjustments to the installation may be requested by the Engineer. The Contractor shall adjust without additional cost to the Owner Representative, where such adjustments are necessary to the proper installation and operation within the intent of the Contract Documents. This does not include work already completed.
   5. Equipment outlines shown on detail plans of 1/4"=1'-0" scale or larger and/or dimensions indicated on the plans are limiting dimensions. Do not install any equipment that exceeds the equipment outlines shown or reduces indicated clearances.
   6. Obtain exact location of connection to equipment, furnished by others, from the person furnishing the equipment.
   7. Drawings and specifications are complementary and what is called for in either on is as binding as if called for in both.
   8. Include the better quality, greater quantity or higher cost for an item or arrangement where a disagreement exists in the drawings and specifications.

1.7 SEQUENCING AND SCHEDULING

A. Refer to General Conditions and Requirements.

1.8 EQUIPMENT INSTRUCTIONS AND PARTS LITERATURE

A. Instruction and parts literature are generally packed with electrical equipment and devices. Contractor shall remove this literature from the packing container or equipment enclosure, identify the literature with the equipment to which it applies, and file the literature in loose-leaf binders with index tabs. Each binder shall have an index which lists each piece of equipment and the literature which applies to it. An index tab shall be provided for each piece of equipment.

B. Contractor shall establish a procedure with the other trades for receiving, identifying, and filing literature for devices which are removed from their packaging and installed by other trades.

1.9 SUBMITTALS

A. Submit the following items consistent with Division 0 and Division 1. Refer to each Section under Division 26 for additional submittal requirements particular to that Section.

B. Prior Approvals:
   1. Submit approval form for each request for prior approval.
   2. Submit hard copy, bound, written requests to use unspecified items, to the Engineer, no later than ten (10) calendar days prior to the bid opening. Submit detailed information for proposed material or equipment specific to the project, clearly indicating all options included in the submittal.
   3. Accepted substitutions will be incorporated in an Addendum to the Contract Documents.
   4. Contractor is responsible for dimensional differences, electrical requirements, and any other resulting changes, when using accepted substitutions. Contractor is responsible for any additional costs incurred because of substitutions, including other contractors and Architect/Engineer fees.
   5. Material and equipment not specified or accepted in an Addendum will be removed and replaced at no cost or inconvenience to the Owner Representative.

C. Work Scope Change:
   1. If a work scope change is requested and Contractor would like to be awarded additional compensation or a deduction from original contract is requested, Contractor shall provide a schedule of values for all associated proposed work.
      a. Schedule of values shall include all proposed material, labor, and other associated costs. Provide a final lump sum number for all work associated with the change and individual pricing for each item on the schedule of values.
      b. Engineer may request additional breakdown for improved clarity and Contractor must comply prior approval for the additional compensation or credit.
   2. Contractor shall provide actual manufacturer and distributer invoices showing cost of work affected by the work scope change upon request of Engineer and/or Owner Representative.
   3. Contractor is solely responsible for delays in schedule where Contractor is required to resubmit documentation, revise requested documentation or provide additional information associated to gaining approval for the work scope change.

D. Shop Drawings and Manufacturer's Information:

1. Submit in accordance with the Division 0 and Division 1. Unless noted otherwise, submit drawings to the Engineer for review within 30 calendar days after award of Contract.
2. Provide separately bound documents for each submittal for each section. Combination submittals will be returned to the Contractor without review and count as 1 submittal. Do not combine submittals from multiple sections.
3. Include project name, name of Architect, name of Engineer, contractor, sub-contractor, manufacturer, supplier and sales representative, include name, address, and phone number for the sales representative. Clearly identify section number and description of equipment submitted. Shop drawings not including all of this information will be returned without review, and count as 1 submittal.
4. Examine all shop drawings noting capacity, arrangement, and physical dimensions. Clearly mark all relevant items on catalog data and cross-out unrelated information.
5. Submittals for equipment provided by the Electrical Contractor shall bear a stamp or specific written certification from the Electrical Contractor, certifying the submittals have been reviewed and approved by the submitting Electrical Contractor.
6. Provide the following shop drawing and manufacturers' information:
    a. Product Data Sheets:
        1) Describe all equipment and devices to be provided.
        2) Include all features specified.
        3) Provide dimensioned prints with weights.
        4) Highlight or otherwise accentuate on each data sheet the specified product features and product numbers.
        5) Features or part numbers which do not apply shall be struck through, crossed out, blacked out, or otherwise identified as not applicable.
    b. Composite Drawing:
        1) Power and control wiring for all systems and equipment.
        2) Show basic systems on composite drawing.
        3) Use terminal numbers on drawings and schematics.
        4) Use separate drawings to show details of sub-systems.
        5) Identify sub-system drawing interface points on composite drawing and sub-system drawings; terminal numbers of interface points shall be the same on both drawings.
        6) Revise or redraw manufacturer's standard drawings to meet above requirements.
    c. Record all Changes to Existing Systems:
        1) Revise all wiring diagrams and schematic diagrams to show final installation:
            a) Includes all new and existing equipment diagrams.
    d. Programmable Systems:
        1) Description of programmable system operation, including but not limited to input/output functions, control capabilities, configuration procedures, starting setpoints, etc.
        2) Preliminary graphic screens and reports.
            a) This submittal shall occur prior to shipment of the system.
    e. Manufacturers Installation Instructions:

1) Include with shipment.

7. If the Engineer rejects (Make corrections noted/Submit corrected copy, Rejected/Submit specified item) two (2) times for material under the same section the Engineer will be compensated for the additional reviews. Compensation will be incorporated by Change Order and deducted from the Contractor's application for payment. Contractor is solely responsible for any project delays caused by having to resubmit submittals.

E. Operating and Maintenance Manuals:
1. Include all the information provided with the approved shop drawings and manufacturer's information.
   a. Update and complete control system drawings and descriptions for all equipment.
   b. All documentation shall include modifications made which reflect the final installation.
   c. All completed testing reports.
2. Date the manuals with the day, month, and year they are provided to the Owner Representative/Engineer.
3. Provide manufacturers' user manuals and installation instructions.
4. Provide 3 hard (paper) copies in a 3-ring binder. Provide a table of contents and each piece of equipment or sub-system shall be tabbed.
5. Provide 2 digital copies in a PDF format saved to a compact disk or USB drive. The saved files shall be clearly identified and organized in a similar manner to the hard copies
   a. Data saved on the disks shall be accessible and neatly organized.
   b. Provide a table of contents which utilizes bookmarks and links. The links shall take the reader to a specific page when the reader clicks on the desired title in the table of contents. A link shall be provided for materials associated with each piece of equipment included in the O&M manual.
6. Record all Changes to Existing Systems
7. Insert revised documents into the Owner Representative's existing operation and maintenance manuals in place of original documents, if such O&Ms exist.

F. Record Documents:
1. Provide three sets of paper copies of record documents and two digital pdf copies. Record Drawings shall be of the same size as the original published contract drawings.
2. Provided with the O&M's.
3. Record drawings shall include all work scope changes, including addenda.
4. Record drawings shall show locations of all above ceiling control devices, such as relays, contacts, control modules, monitor modules, fire/smoke detection equipment, etc.
5. Refer to Division 0 and Division 1 for additional Record Drawing requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Continuity of existing systems:

1. No Division 28 systems are to remain inactive at the end of the workday. Assure that the systems are all operational at the end of each workday. Coordinate temporary outages with the Owner Representative.
2. Coordinate/schedule all work with the Owner Representative to minimize any disruptions. Confine all interruptions to the smallest possible area. Provide temporary connections if required to provide continuity of service.
3. Inspect all areas affected by the interruptions and return all automatically controlled equipment, electrically operated equipment to the same operating condition prior to the interruption.

B. Use of Facility:
1. Do not disturb normal use of the facility, except within the immediate construction area. Keep walks, driveways, entrances, etc. free and clear of equipment, material and debris.
2. Store all equipment and material in a place and manner that minimizes congestion and is approved by the Owner Representative.

3.2 INSTALLATION

A. Material and Workmanship
1. Provide new material and equipment, unless noted otherwise. Protect equipment and material from damage, dirt and the weather.
2. Provide the highest quality workmanship and perform all work only by skilled mechanics. Install material and equipment in accordance with manufacturers' recommendations, instructions and current NECA standards.
3. The Engineer reserves the right to reject material or workmanship not in accordance with the specifications, before or after installation.

B. Cutting and Patching:
1. Perform all cutting and patching necessary to work, unless specifically delegated to be performed by a different Division.
2. Obtain special permission from the Engineer before cutting structural members or finished material.
3. Perform all patching in a manner as to leave no visible trace and return the area affected to the condition of undisturbed work. Perform all patching by workers experienced, skilled, and licensed for the work involved. Inferior work will not be accepted.
4. Patch all holes left because of demolition of electrical equipment and devices.
5. Drill all holes in masonry with rotary drill. Impact tools are not allowed. Core drill all holes in masonry and concrete for electrical raceway. Provide and dispose of all water required for core drilling. Coordinate with other trades to prevent damage from water.
6. Prevent the spread of dust, debris, and other material into adjacent areas.
7. Replace all ceiling tiles damaged during installation of work with new tile.

C. Painting:
1. Refinish all fire alarm equipment damaged during shipping and/or installation to its original condition. Remove all rust; prime, and paint per manufacturer's recommendations for finish equal to original.
2. Paint all new raceway systems in exposed finished areas to match existing finish.

3.3 EXISTING CONSTRUCTION

A. All modifications to the fire alarm systems shall be staged to limit the frequency and duration of alarm system impairments. Systems shall always be operable.

B. The Contractor shall notify the Owner Representative in writing at least two working days in advance of any impairment. The maximum planned impairment duration shall be 8 hours.

C. No more than one smoke compartment of a building will be allowed to be impaired at one time. For buildings which are not separated into smoke compartments no more than one floor of the building will be allowed to be impaired at one time.
   1. The impaired area of the building shall not be left unattended by the Contractor's personnel during an impaired state. Contractor shall provide fire watch personnel during an impairment period.
   2. If unavoidable or in the event of an unplanned incident, the Contractor shall notify the Owner Representative's Representative of any impairment lasting more than 8 hours.

3.4 FIELD QUALITY CONTROL

A. Final Inspection:
   1. A final inspection of the electrical systems will be required before the Contract can be closed out. Request a final inspection by the Engineer after all systems are fully completed and operational. The Engineer will schedule an inspection and generate a list of items to be corrected or completed before Contract Closeout. If the Engineer is requested to make a final inspection by the Contractor, and the Engineer finds the work is not complete enough to perform that inspection, the Contractor will compensate the Engineer for his time. The Contractor will then perform the necessary work to complete the project and again request a Final Inspection.

3.5 CLEAN UP

A. Keep the premises free from accumulation of waste material or rubbish, caused by his employees or work, always. Remove rubbish, tools, scaffolding, and surplus materials from and about the building, and leave work areas "broom clean" or its equivalent upon completion of the work. Clean electrical equipment and remove temporary identification. In case of dispute the Owner Representative will remove the rubbish and charge the cost to the Contractor.

B. After tests have been completed and accepted, clean light fixtures, panels and other equipment installed by the Contractor, leaving the entire work area in a clean and complete working order.

3.6 PROTECTION

A. Cover openings and equipment, where set, to prevent obstruction to raceways, breakage, misuse, or disfigurement of equipment. Cover openings in equipment immediately upon uncrating or receipt at the job site and keep covered until permanent connection is made.

B. Contractor is responsible for any damage to electrical equipment or materials until final acceptance of the entire project by the Owner Representative. Keep all equipment clean materials until final acceptance of the entire project by the Owner Representative.

C. If a portion of the project is to be occupied by the Owner Representative prior to Substantial Completion of the entire project make arrangements with the Owner Representative to transfer responsibilities for protection and housekeeping.

END OF SECTION

SECTION 28 05 15

TESTING OF FIRE ALARM SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Testing Fire Alarm Systems.

PART 2 PRODUCTS

2.1 MATERIALS

A. Miscellaneous testing equipment as detailed.

PART 3 EXECUTION

3.1 FIRE ALARM SYSTEM TESTING

A. Inspect the fire alarm system with the manufacturer's representative of the fire alarm equipment, including those components necessary to the direct operation of the system such as manual stations, thermal detectors, smoke detectors, flow switches and controls, whether or not manufactured by the manufacturer. The inspection to comprise examination and certification of such equipment for the following:
   1. The system functions properly.
   2. The type of equipment installed is designated by the Engineer's specifications.
   3. The wiring connections to all equipment components have been installed in accordance with UL requirements.
   4. Equipment of the manufacturer has been installed in accordance with the manufacturer's recommendation and that all signaling devices of whatever manufacturer have been operated or tested to verify their operation: The supervisory wiring of those items of equipment connected to a supervised circuit is operating and that the regulations, if any, concerning such supervisory wiring, have been met to the satisfaction of inspecting officials.

B. Inspection Certification: Upon completion of the inspection and when all the above conditions have been complied with, the manufacturer is to issue to the Engineer:
   1. A copy of the inspecting technician's report showing location of each device and certifying the test results of each device.
   2. A certificate of verification confirming that the inspection has been completed and accepted by the authority having jurisdiction and showing the conditions upon which such inspection and certification have been rendered.

C. Owners Instruction: The manufacturer provides the services of a competent alarm system technician for the period of two working days, at a time convenient to the Owner, to instruct the staff in the operation and maintenance of the system.

D. Provide complete UL testing of the entire fire alarm system including all new. Field verify exact mounting locations of all fire alarm devices.

E. Provide a letter to the Owner and Fire Marshal certifying that the installed system is UL certified.

END OF SECTION

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Fire Alarm System

B. Interface to HVAC Systems

C. Interface to Automatic Closing and Self-Closing devices

D. Interface to Fire Protection System

E. Interface to Owner Telephone system

1.2 RELATED SECTIONS

A. Section 26 05 00: Common Work Results for Electrical

B. Section 26 05 26: Grounding and Bonding for Electrical Systems

C. Section 26 05 29: Supporting Devices

D. Section 26 05 33: Raceways, Fittings, and Boxes

E. Section 28 05 00: Common Work Results for Electronic Safety and Security

F. Section 28 05 15: Testing of Fire Alarm Systems

1.3 SYSTEM DESCRIPTION

A. The fire alarm and detection system shall be designed and provided by the Contractor. The Contractor designed system shall fulfill all applicable codes, standards and authorities having jurisdiction. The scope of this system is indicated to some extent, but not a fully complete design, in the Contract Documents. The project intent is for Contractor to provide a system that meets Owner/User expectations and all extents of applicable codes.

B. Contractor shall provide with respect to his design: Certifications, signatures, stamps, seals, etc. by persons, such as technicians, engineers, etc. meeting all qualifications required by codes and authorities having jurisdiction.

C. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

E. Provide a complete operational fire alarm system including the following components: Main control panel, remote annunciators with alarm silence and reset capability; remote detectors; interfaces to HVAC fans, combination smoke/fire dampers and sprinkler systems; audible and visual indicating devices; monitor and control modules; communication devices; raceway system, boxes, wiring, grounding and the associated labor, programming, setup, and testing.

F. Where materials, equipment or system descriptions appear in the Contract Documents which may violate an applicable code, Contractor shall notify Engineer before installing such items.

G. Provide a two wire Class B, low voltage, power limited, ADA compliant, addressable, closed circuit, electrically supervised, non-coded, temporal sounding type system as described in NFPA 72.

H. Provide individual alarm and trouble indication for each initiating device.

I. Provide a clear distinction (at the main control panel and remote annunciators) between the alarm notification signal and the trouble notification signal.

J. Provide automatic HVAC system shut down for air handling units that move an air volume in excess of 2000 cfm. Provide duct detectors in the return ducts, and addressable control modules at each motor starter.

K. Provide remote annunciators where shown on Drawings. Verify exact location of remote annunciators with the Owner.

L. Provide power and control wiring to automatic closing and self-closing devices (door holders, fire shutters, smoke dampers, etc.), relays, HVAC unit starters, and any other interfaces to equipment required to be interfaced to the fire alarm system.

M. The FACP and peripheral devices shall be manufactured 100% by a single manufacturer (or division thereof).

N. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

1.4 SYSTEM PERFORMANCE

A. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).

B. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

C. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

D. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

E. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.

F. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone whichever is greater.

G. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.

H. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.

I. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B (Style Y), or two Class A (Style Z) circuits.

J. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:
   1. The digital amplifier shall automatically broadcast the stored audio message.
   2. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
   3. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
   4. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
   5. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.
   6. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.

K. The system shall be complete in every detail, whether such detail is specifically shown or not.

L. Provide all materials, products, wiring, labor, equipment, programming, services, etc. required for a fully complete and operational system.

M. The contractor shall provide all interlocks, interfaces, etc. as necessary to integrate his system with other systems.

N. The contractor shall include all fees and any other costs associated with the system.

O. Contractor shall provide all associated products and services including but not limited to:
   1. Written, at minimum, two-year warranty which begins at substantial completion.
   2. Operation and maintenance manual including all information necessary to operate and maintain system.
   3. Programming and setup.
   4. Start-up, troubleshooting and debug.
   5. Instruction Owner.
   6. Demonstrating system to Owner, Inspector, etc.
   7. As-built drawings in every detail.
   8. Parts list.
   9. Testing in accordance with all applicable standards and to the satisfaction of the authorities having jurisdiction.

1.5 OPERATION

A. It is the responsibility of the Contractor to visit the site and record all pertinent data and information of the existing system and facility which would affect the bid price before the bid is submitted.

B. The FACP shall be capable of communicating over a Local Area Network (LAN) or Wide Area Network (WAN). The network shall be MESH type (capable of both series, series-parallel and single network bridge) communications allowing for multiple Class X/A/B rings within the system. Each node shall be an equal, active functional member of the network, capable of making all local decisions, local pre-recorded voice message storage and initiating network tasks for other nodes. In the event of a node failure or communications failure between nodes, nodes shall be capable of forming sub-networks and remain operational between communicating nodes with all pre-recorded voice message announcements. No central storage of pre-recorded messages will be acceptable.

1.6 SUBMITTALS

A. Submit qualifications of the system installer as specified in this section.

B. Submit a complete shop drawing package of the proposed system.

C. Provide clearly legible shop drawings.

D. Submit shop drawings in a neatly bound comb or three ring binder with protective covers. Indicate on the front cover the date submitted, project name, specification section number, electrical contractor's name, address, telephone number and the submitting equipment supplier’s address and telephone number. Allow enough clear area on the title sheet for shop drawing review stamps.

E. Submit 1/8” scale reproducible floor plans showing all rooms, stairways, corridors, horizontal exits, controlled HVAC units, sprinkler flow and control valves, and all fire alarm system components. The drawings shall include exact wire counts, types, and point address information for each device. Single line for walls may be used.

F. Submit the following riser/wiring/connection diagrams:
   1. Single line riser drawing indicating all system components and the vertical wiring necessary to connect the components. Indicate conduit sizes and wire counts and a legend indicating the type of wiring.
   2. Functional block diagram showing initiating device wiring, loop communications wiring, annunciator wiring, power supply wiring, indicating device wiring, power supply wiring, battery wiring, communications/modem wiring, etc. It is not necessary to show every initiating and indicating device on the riser diagram but illustrate the wiring and connection of each type of device on each addressable loop. Indicate on the diagram the quantity of devices on each loop and the maximum allowable quantity of devices on each loop (to determine the number of spare addresses for future expansion).
   3. Wiring diagrams showing wiring and terminations between HVAC fan units and the fire alarm system.
   4. Wiring diagrams showing wiring and terminations between combination fire/smoke dampers and the fire alarm system.
   5. Wiring diagrams showing wiring and terminations between self-closing and automatically closing devices and the fire alarm system.
   6. Wiring diagrams showing wiring and terminations between sprinkler system flow switches, valve position switches, dry pipe low pressure monitoring switches, etc., and the fire alarm system.
   7. Branch circuit wiring to the main control panel, sub-panels, and other devices in the system requiring 120 volt power.

G. Submit original drawings produced by the supplier/manufacturer. Submitting reproductions of the Contract Documents is not acceptable.

H. Submit a material list showing quantity, manufacturer, type, and description of each item being furnished. Indicate in a separate list, the quantity and description of all spare parts to be turned over to the Owner at the end of the project.

I. Submit original prints of the manufacturer product sheets with complete technical data for each item being provided. Circle, arrow or provide other permanent marking on each data sheet to clearly indicate the specific product included in the submittal. Remove or crosshatch out any product on the data sheets not applicable to the project or not being submitted for review.

J. Submit physical and schematic drawings of special and custom components or hardware.

K. Submit power supply sizing and battery sizing calculations showing total fire alarm system power draw in the supervisory and alarm conditions.

L. Submit complete description of system operating sequence.

M. Equipment mounting details and instructions are to be provided to installing Contractor before installation of equipment.

N. Submit complete description of system operating sequence.

O. Shop drawings not containing all the information listed above will be rejected without review.

P. Engineer review of shop drawings does not vacate responsibility of contractor to provide a functioning system meeting the Owner/User expectations and all extents of applicable codes.

1.7 QUALITY ASSURANCE

A. Only manufacturers that provide complete engineering, technical and support services to properly complete the project as designed are allowed.

B. Provide the following, prepared by the manufacturer and supplier:
   1. Certification of project and drawings.
   2. Project management as required by Engineer and Owner.
   3. Complete project testing and training to Engineers and Owners satisfaction.
   4. Underwriters Laboratories (U.L.) Certification.
   5. Service personnel to be NICET Level II Certified.
   6. Maintained inventory levels to provide service parts as required by the specification.

C. Provide the service of a NICET level II, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

D. Provide fire alarm and detection systems conforming to the requirements of the latest edition of the following National Fire Protection Association (NFPA) publications including all amendments to these publications:
   1. No. 12 Extinguishing Systems (low and high)
   2. No. 12A Halon 1301 Extinguishing Systems
   3. No. 13 Sprinkler Systems
   4. No. 15 Water Spray Systems
   5. No. 16 Foam / Water Deluge and Spray Systems
   6. No. 2001 Clean Agent Extinguishing Systems
   7. 71: Protective Signaling Systems.
   8. No. 72 National Fire Alarm Code.
   9. No. 90A Air Conditioning Systems
   10. No. 92A Smoke Control Systems
   11. No. 92B Smoke Management Systems in Malls, Atria, Large Are-as
   12. No. 72 National Fire Alarm Code
   13. No. 101 Life Safety Code

E. Construct and install all fire alarm and fire detection equipment in accordance with the following publications:
   1. Underwriters Laboratories Inc. (UL):
      a. No. 268 Smoke Detectors for Fire Protective Signaling Systems
      b. No. 864 Control Units for Fire Protective Signaling Systems
      c. No. 2572 Mass Notification Systems
      d. No. 217 Smoke Detectors, Single and Multiple Station
      e. No. 228 Door Closers - Holders for Fire Protective Signaling Systems

f. No. 268A Smoke Detectors for Duct Applications
g. No. 521 Heat Detectors for Fire Protective Signaling Systems
h. No. 464 Audible Signaling Appliances
i. No. 38 Manually Actuated Signaling Boxes
j. No. 1481 Power Supplies for Fire Protective Signaling Systems
k. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
l. No. 1971 Visual Notification Appliances
m. No. 2017 Standard for General-Purpose Signaling Devices and Systems
n. No.60950 Safety of Information Technology Equipment

2. Americans with Disabilities Act.
3. International Fire Code (IFC).
4. International Mechanical Code (UMC).
5. International Building Code (IBC).
6. State Building Code
7. Minnesota Amendments to the IBC, IMC and IFC.
8. Local (City) Codes

F. Provide components that are listed and cross listed as a product of a single fire alarm system manufacturer by Underwriter's Laboratory, Inc. (U.L.) and bear the "U.L." label. Provide control equipment listed under U.L. category UOJZ as a single control unit.

G. Qualifications of the Installer:
1. Before commencing work, submit data showing that the contractor/subcontractor has successfully installed fire alarm systems of the same type and design as specified. Include the names, locations, and the contact name and telephone number of at least six (6) such installations completed by the installer. Specify type and design for each system and furnish documentation that the system has performed satisfactorily for the preceding eighteen (18) months.
2. Provide evidence of completion of the required manufacturers' training and experience by the contractor or have NICET Level II (or higher), Certified Fire Alarm or Special Hazard Associate Engineering Technician(s), as applicable, in their employ.
3. Experience of Installer: Accomplish installation by a Contractor with a minimum of five years' experience in the installation of the specified fire alarm system. Any proposed installer who cannot show evidence of such qualifications will be rejected.

H. Manufacturer's Representative
1. Provide the services of a representative or technician licensed in the State of Minnesota from the manufacturer of the system, or a factory trained technician of the manufacturer of the system, experienced in the installation and operation of the type of system provided. Supervise installation, software documentation, adjustment, preliminary testing, final testing, and certification of the system. Provide the required instruction to the Owner's personnel in the system operation, maintenance, and programming.

1.8 OWNER PREFERRED VENDOR

A. Division 26 contractor shall sub-out all work pertaining to Division 28 – Fire Alarm to ECSI, the Owner's preferred Fire Alarm vendor. ECSI shall refer to the Documents and the Division 28 specifications to define scope of work. ECSI shall also coordinate any additional scope of work with Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Contractor shall field verify existing systems manufacturer. Contractor shall provide manufacturer as required to maintain a UL rating and to meet the requirements of governing codes. Where existing manufacturer may not be required to be matched, systems manufactured by the following are approved for bidding purposes on this project. Approval for installation is subject to review and approval of shop drawings.
   1. Honeywell-Notifier.
   2. Edwards.
   3. Siemens.

2.2 MAIN FIRE ALARM CONTROL PANEL:

A. Main FACP shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices.

B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
   1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
   2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
   3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed in the event of CPU failure.

2.3 SYSTEM CAPACITY AND GENERAL OPERATION

A. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support at least 250 analog/addressable devices for a minimum system capacity of 2500 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a minimum 768-character liquid crystal display, individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall be capable of displaying 8 simultaneous events.

B. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an

alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

C. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.

D. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.

E. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.

F. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.

G. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.

H. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.

I. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.

J. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.

K. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.

L. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.

M. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions.

N. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.

O. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

P. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.

Q. Active Event: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.

R. Non-Fire Alarm Module Reporting: A point with a type ID of Non-Fire shall be available for use for energy management or other non-fire situations. Non-Fire point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a Non-Fire point shall activate control by event logic but shall not cause any indication on the control panel.

S. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

T. Security Monitor Points: The system shall provide means to monitor any point as a type security.

U. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system.
   1. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state.
   2. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

V. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a

point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.

W. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.

X. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24-hour time schedule on any day of the week or year.

Y. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

Z. Central Processing Unit
   1. The Central Processing Unit shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory and shall not be lost with system primary and secondary power failure.
   2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
   3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment.
   4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
   5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
   6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.
   7. During system download of the database, the System shall be completely operational.

AA. Loop (Signaling Line Circuit) Control Module:
   1. The Loop Control Module shall monitor and control a minimum of 250 intelligent addressable devices. This includes 125 intelligent detectors (Ionization, Photoelectric, or Thermal) and 125 monitor or control modules.

2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit. Fault isolation modules shall be installed between each addressable SLC device per the manufacturers installation instructions. Systems which cannot provide full loop loading in Style 7 configurations are not acceptable.
4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

BB. Digital Voice Command Center
1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
2. Function: The Voice Command Center equipment shall perform the following functions:
    a. Operate as a supervised multi-channel emergency voice communication system.
    b. Operate as a two-way emergency telephone system control center.
    c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
    d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
    e. Provide all-call Emergency Paging activities through activation of a single control switch.
    f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
    g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
    h. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.

i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
j. The Digital Voice Command shall be modular in construction and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

CC. Power Supply:

1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. The Main Power Supply shall be power-limited per UL864 requirements.
6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunciated and logged to the system alarm history log.
7. Charger Power Supply: The auxiliary power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power.
8. The power supply for the fire and gas detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.
9. The power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "A" or Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.
10. The power supply shall operate on 120 or 240 VAC, 50/60 Hz.
11. The power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
12. Each of the power supply's four output circuits shall be programmed for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.

13. The power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
14. When selected for Notification Appliance Circuits, the output circuits shall be individually set for Steady, March Time, Dual Stage or Temporal.
15. The power supply shall interface and synchronize with other power supplies of the same type.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

DD. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power (@25 Volts RMS@70 Volts RMS) for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:
    a. Earth Fault on DAP A (Digital Audio Port A)
    b. Earth Fault on DAP B (Digital Audio Port B)
    c. Audio Amplifier Failure Detected Trouble
    d. Active Alarm Bus input
    e. Audio Detected on Aux Input A
    f. Audio Detected on Aux Input B
    g. Audio Detected on Firefighter's Telephone Riser
    h. Receiving Audio from digital audio riser
    i. Short circuit on speaker circuit 1
    j. Short circuit on speaker circuit 2
    k. Short circuit on speaker circuit 3
    l. Short circuit on speaker circuit 4
    m. Data Transmitted on DAP A
    n. Data Received on DAP A
    o. Data Transmitted on DAP B
    p. Data Received on DAP B
    q. Board failure
    r. Active fiber optic media connection on port A (fiber optic media applications)
    s. Active fiber optic media connection on port B (fiber optic media applications)
    t. Power supply Earth Fault
    u. Power supply 5V present
    v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble
4. The audio amplifier shall provide the following built-in controls:
    a. Amplifier address selection switches

b. Signal silence of communication loss annunciation reset
c. Level adjustment for background music
d. Enable/disable for earth fault detection on DAP A
e. Enable/disable for earth fault detection on DAP B
f. Switch for 2-wire/4-wire FFT riser

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.
8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

EE. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
   a. Lamp test
   b. Trouble
   c. Off-line trouble
   d. Microphone trouble
   e. Phone trouble
   f. Busy/wait
   g. Page inhibited
   h. Pre/post announcement tone

FF. Controls with associated LED Indicators:

1. Speaker Switches/Indicators
   a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
   b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
2. Emergency Two-Way Telephone Control Switches/Indicators
   a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.

b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

GG. Remote Transmissions:
1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

HH. Field Programming:
1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information. It shall be possible to program through the standard FACP keyboard all system functions.
2. All field defined programs shall be stored in non-volatile memory.
3. The system programming shall be "backed" up via an upload/download program and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.

II. Specific System Operations:
1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

JJ. System Point Operations:
1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.

3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
    a. Device Status.
    b. Device Type.
    c. Custom Device Label.
    d. Software Zone Label.
    e. Device Zone Assignments.
    f. Analog Detector Sensitivity.
    g. All Program Parameters.
4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
5. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
6. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
7. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

2.4 SYSTEM COMPONENTS:

A. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.
    1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
    2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
        a. Communication shall include vital system status such as:
        b. Independent Zone (Alarm, trouble, non-alarm, supervisory)
        c. Independent Addressable Device Status

d. AC (Mains) Power Loss
e. Low Battery and Earth Fault
f. System Off Normal
g. 12 and 24 Hour Test Signal
h. Abnormal Test Signal (per UL requirements)
i. EIA-485 Communications Failure
j. Phone Line Failure

3. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
4. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
5. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
6. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over Cellular (GSM) network to a compatible receiver.

B. Field Wiring Terminal Blocks:
1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

C. Smoke Control Annunciator
1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled.

Systems that indicate on/off/auto by physical switch position only are not acceptable.

2.5 SYSTEM COMPONENTS – ADDRESSIBLE DEVICES:

A. Addressable Devices – General

1. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
2. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
3. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
4. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
5. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
6. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
7. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
8. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
9. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
10. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

11. Addressable modules shall operate on single twisted pair cable, unless noted otherwise.

B. Remote Annunciator Panels
   1. Provide remote annunciator panels with the following specifications:
      a. Mounted in vandal-proof enclosure (specified elsewhere herein).
      b. All switches, buttons and indicators located behind a transparent faceplate.
      c. Supervised wiring between annunciator and the main control panel.
      d. 80 character display.
      e. Powered from the main control panel.
      f. Unique alarm and trouble notification signal at panel. Acknowledge, reset, silence and scroll forward and back functions for viewing system event history log.
      g. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.

C. Manual Pull Stations
   1. Provide manual pull stations with the following specifications:
      a. Single action type (non-break glass type).
      b. Die cast aluminum construction with baked red enamel finish.
      c. Semi flush mounted to recessed backbox.
      d. Pull lever locks in the protruding position when actuated.
      e. Key lock switch for resetting handle and for testing purposes.
      f. Fully enclosed silver plated contacts configured as normally open or normally closed.
      g. UL listed.
   2. Provide manual station with addressable communications module.
   3. Provide unique address assignment for each detector assigned by the main control panel.

D. Intelligent Automatic Photoelectronic Smoke Detectors
   1. Provide automatic photoelectronic smoke sensors with the following specifications:
      a. Utilizes light scattering principle from an internal infrared LED light source and reports the percent obscuration to the main control panel.
      b. Factory set threshold at a nominal 1.5% light obscuration per foot (set via the main control panel)
      c. Operates +14 to +120 degree F temperature, 10% to 93% humidity range.
      d. Self-compensating drift compensation for maximum stability (set via the main control panel).
      e. Listed U.L. 268 7th Edition.
   2. Provide manual station with addressable communications module.
   3. Provide unique address assignment for each detector assigned by the main control panel.

E. Intelligent Automatic Heat Detectors
   1. Provide automatic heat detectors with the following specifications:

a. Utilizes a combination of fixed temperature and rate of rise compensation (temperature exceeds 15 degree per minute rise, set via the main control panel).
b. Operates at +14 to +122 degree F temperature, with relative humidity less than 93%.
c. U.L. 521 listed.

2. Provide manual station with addressable communications module.
3. Provide unique address assignment for each detector assigned by the main control panel.
4. Provide ordinary rated (135 degree F) detectors in normal spaces. Provide intermediate rated (175 degree F) in unconditioned spaces such as boiler rooms or other areas with a high ambient temperature.

F. Intelligent Photoelectronic Duct Smoke Detectors
1. Provide automatic photoelectronic duct smoke sensors with the following specifications:
a. Utilizes light scattering principle from an internal infrared LED light source and reports the percent obscuration to the main control panel.
b. Factory set threshold at a nominal 1.5% light obscuration per foot (set via main control panel)
c. Self-compensating drift compensation for maximum stability (set via main control panel).
d. Operates at air velocities from 300-4000 ft/min, +32 to +120 degree F operating temperature, 10%-93% humidity range.
e. Smoke chamber blocks particles larger than 200 microns.
f. U.L. 268 listed.

2. Provide detector base with addressable communications module.
3. Provide unique address assignment for each detector assigned by the main control panel.
4. Provide HVAC duct-mounted housing and sampling tubes of the proper length to sample the entire width of the HVAC duct. Provide additional duct smoke detectors as required for ducts wider than the longest sampling tube recommended by the fire alarm manufacturer.
5. Provide addressable control module and associated relay rated at 10 amps for connection to HVAC unit starter circuit for fan motor shutdown. Provide unique address assignment for each control module assigned by the main control panel.
6. Provide addressable control module and associated relay for connection to combination smoke/fire dampers. Provide unique address assignment for each control module, either through DIP switches located in the control module or assigned by the main control panel.
7. Provide remote test station for each duct detector in a readily accessible location near the unit. Provide engraved label on remote test station denoting the location, HVAC unit number, “RETURN”, damper location, etc. as required to identify the detector’s location and function.

G. Automatic-Closing and Self-Closing Devices

1. Includes magnetic door holders, automatic doors and rolling fire shutters (provided by others)
2. Provide magnetic door holder with the following specifications:
    a. Minimum holding force of 25 lbs.
    b. Surface, wall mounted.
    c. Operates at 24 VDC from the fire alarm panel.
    d. U.L. listed.
3. Provide interface wiring between each closing device and the fire alarm system.
4. Provide power to 24 VDC and 120 VAC closing devices.
5. Provide addressable control module at each closing device to allow the main control panel to actuate each closing device independently.
6. Provide unique address assignment for each self-closing device assigned by the main control panel.
7. Provide addressable control module wiring between each closing device and the fire alarm system to allow the main control panel (through software) to operate the devices in either of two ways:
    a. Any alarm in the building closes all automatic closing and self-closing devices.
    b. Only the detectors adjacent to the automatic closing and self-closing devices close the devices.

H. Two Wire Detector Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device.)
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits

I. Addressable Control Module
1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits.

J. Addressable Releasing Control Module
1. An addressable releasing module shall be available to supervise and control compatible releasing agent solenoids.
2. The module shall operate on a redundant protocol for added protection.

3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.
4. Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display.
5. The module shall support programming of up to five programmable event thresholds.

K. Addressable Relay Module:
1. Addressable Relay Modules shall be available for HVAC control and other network building functions.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

L. Addressable Two-In / Two-Out Monitor/Relay Module:
1. An addressable Two-In/Two-Out module shall be available.
2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

M. Isolator Module:
1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

N. Alarm Indicating Speakers:
1. Provide alarm indicating speakers with the following specifications:
   a. Temporal sounding pattern of ½ to 1 sec ON, followed by ½ to 1 second OFF for three cycles, followed by a 1½ to 2 second OFF period for no less that 180 seconds.
   b. Semi-flush mounting to 4-inch square electrical box

c. 12VDC or 24 VDC operation powered from the main control panel.
d. Speakers shall provide 1/4w, 1/2w. 1w, and 2w power taps for use with 70V systems. The actual speaker wattage and strobe candela setting shall be viewable from the device window to verify wattage setting, without removing the device. To make any changes to the speaker wattage will only require the removal of the cover plate.
e. Speaker shall be listed in compliance to produce 520Hz low frequency tone signal.
f. The following selectable sound level output:
    1) ¼ watt – 78 dBA
    2) ½ watt – 81 dBA
    3) 1 watt – 84 dBA
    4) 2 watt – 87 dBA
g. A minimum 90.5dB output at 10 feet on axis.
h. Frequency Range: 400 to 4,000 Hz (Fire Alarm), 200Hz – 15KHz (General signaling)
i. Red with white "Alert" lettering.
j. Supervised wiring.
k. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
l. U.L. listed, ADA compliant.

O. Alarm Indicating Strobes
1. Provide alarm indicating strobes with the following specifications:
    a. Semi-flush mounting to 4-inch square electrical box
    b. 24 VDC operation powered from the main control panel.
    c. In rooms larger than 1600 square feet
        1) Minimum 120 candela when measured on axis.
        2) Rated for wall mount applications per UL 1971 at a minimum of 110 candela effective intensity.
    d. Non-assembly rooms and corridors
        1) Minimum 75 candela when measured on axis
        2) Rated for wall mount applications per UL 1971 at a minimum of 15 candela effective intensity.
    e. One to three flashes per second with a one (1) hertz synchronous flash pattern in accordance with ADA.
    f. Red with white "Fire" lettering. Vandal-proof polycarbonate lens.
    g. Supervised wiring
    h. U.L. 1971 listed, ADA compliant

P. Alarm Indicating Speaker/Strobe Unit
1. Provide alarm indicating speaker/strobes with the following specifications:
    a. Temporal sounding pattern of ½ to 1 sec ON, followed by ½ to 1 second OFF for three cycles, followed by a 1½ to 2 second OFF period for no less that 180 seconds.
    b. Semi-flush mounting to 4-inch square electrical box

c. 12VDC or 24 VDC operation powered from the main control panel.
d. Speakers shall provide 1/4w, 1/2w. 1w, and 2w power taps for use with 70V systems. The actual speaker wattage and strobe candela setting shall be viewable from the device window to verify wattage setting, without removing the device. To make any changes to the speaker wattage will only require the removal of the cover plate.
e. Speaker shall be listed in compliance to produce 520Hz low frequency tone signal.
f. The following selectable sound level output:
    1) ¼ watt – 78 dBA
    2) ½ watt – 81 dBA
    3) 1 watt – 84 dBA
    4) 2 watt – 87 dBA
g. A minimum 90.5dB output at 10 feet on axis.
h. Frequency Range: 400 to 4,000 Hz (Fire Alarm), 200Hz – 15KHz (General signaling)
i. In rooms larger than 1600 square feet
    1) Minimum 120 candela when measured on axis
    2) Rated for wall mount applications per UL 1971 at a minimum of 110 candela effective intensity.
j. Non-assembly rooms and corridors
    1) Minimum 75 candela when measured on axis
    2) Rated for wall mount applications per UL 1971 at a minimum of 15 candela effective intensity.
k. One to three flashes per second with a one (1) hertz synchronous flash pattern in accordance with ADA.
l. Red with white “Alert” lettering.
m. Supervised wiring.
n. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
o. U.L. listed, ADA compliant

Q. System Wire and Cable
1. Provide all conductors and cables in conformance with the National Electrical Code.
2. Size all initiating and indicating circuit wiring as recommended by the system manufacturer. Provide minimum 14 AWG size for indicating and control circuits, and 18 AWG for initiating circuits.
3. Provide shielded cable to minimize RFI if recommended by the manufacturer.
4. Provide maximum individual circuit voltage drop of 15% at the most distant device; or less if necessary to meet the manufacturer’s operating voltage range for all devices.

R. Vandal Guards for Unit Battery Equipment

1. Provide vandal guards in all gymnasiums, wrestling room, and locker rooms in addition to when indicated on the plans, that adhere to the following minimum specifications:
    a. Separate wire guards, mounts to wall. Guards that mount directly to fixtures are not acceptable.
2. Approved Manufacturers:
    a. Safety Technology International, Inc.
    b. Or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide a complete and fully operational fire alarm and detection system as described herein and as shown on the drawings. Installation shall be in accordance with the NEC, NFPA 72, local and state codes as well as recommended by the major equipment manufacturer.

B. Provide all wiring, conduit, junction boxes and outlet boxes required for the system, including terminations to initiating, indicating and control devices furnished by others.

C. Install all wiring in concealed conduit where possible. Provide surface raceway and boxes in finished areas of existing construction, where concealed conduit cannot be accomplished. Reuse existing conduit and boxes wherever possible. Above ceiling wiring may be ran exposed.

D. Paint all junction boxes red and label “Fire Alarm”.

E. Provide plain English description of the location of each initiating device (zone). Coordinate wording of each device with the Owner.

F. Provide a laminated floor plan showing all device locations, addresses and plain-English description of the location. Mount the plan adjacent to the annunciator panel in the building Engineer’s office.

G. Provide color coded wiring throughout. Test all wiring for opens, shorts and grounds before system startup.

H. Terminate all fire alarm wiring at terminal strips at the main control panel and all annunciator panels. Identify each cable with a number corresponding to a wiring diagram to be submitted in the O&M manuals. Neatly arrange cabling around the sides of the cabinets to facilitate servicing of equipment and modules.

I. Provide the required system programming. Coordinate with the Owner all plain English address points, alarm verification presets, passwords, communication dialer protocol information, etc.

J. Verify locations of sprinkler waterflow switches and valve position switch locations in field. Provide wiring and make terminations to sprinkler waterflow devices and valve position switches that are existing to remain.

K. Provide and install power to magnetic door holders, including wiring and connections through the associated smoke detector. Wire existing magnetic door holder wiring

through the associated smoke detector base for automatic closure if the smoke detector senses smoke.

L. Provide and connect wiring from the duct smoke detector control modules to associated motor controllers.

M. Install smoke detectors after the site is free from abnormal dust and dirt conditions or provide manufacturer-approved protective cover over the device until the site is clean.

N. Provide permanent labels for controls and indicators.

O. Provide Form C relays where required to control line voltage equipment.

P. Mount fire alarm devices to electrical boxes.

Q. Locate automatic detectors a minimum of 36 inches away from supply air diffusers.

R. Modify existing ceiling tiles where new devices are shown. Replace ceiling tiles where existing devices are not replaced. Coordinate ceiling tile manufacturer with Owner.

S. Ceiling mounted speakers shall be fully recessed and installed with the manufacturer's recommended mounting hardware. Wall mounted speakers and speaker/strobe appliances shall be flush mounted. In unfinished areas where flush mounting wall appliances is impractical, the Contractor shall verify surface area mounting is acceptable through Owner Representative.

3.2 MOUNTING HEIGHTS

A. Mounting heights of devices shall be in compliance with NFPA 72 and governing codes and requirements. Where not otherwise indicated, the following mounting heights above finished floor shall be used.
   1. Pull Stations: 48” to the operable device.
   2. Wall mounted audible notification devices: top above finished floor at height of not less than 90” and below the finished ceiling no less than 6”.
   3. Wall mounted visual notification devices: entire lens is not less than 80” and not greater than 96” above finished floor.

B. Devices of similar type shall be mounted at the same mounting height throughout the facility.

3.3 ELECTRIC FIRE AND SMOKE DAMPERS

A. Wiring for fire alarm and other life safety monitoring and alarm shall be provided under Division 28. Provide connection to all existing electrical dampers.

B. Contractor is responsible for coordinating locations and requirements of the electric dampers with existing drawings if not shown on the Documents.

3.4 VANDAL GUARDS

A. Provide a vandal guard over each device located in gymnasiums and on the building exterior.

B. Securely mount guards to structure using standard hardware with dedicated anchors. Refer to Section 26 05 29 - Supporting Devices.

C. Provide a minimum of four anchors (1 per corner), or additional if recommended by the guard manufacturer.

3.5 EMERGENCY RESPONDER RADIO COVERAGE

A. The contractor shall provide equipment and systems to meet the state requirements for Emergency Responder Radio Coverage. The Contractor designed system shall fulfill all applicable codes, standards and authorities having jurisdiction. The project intent is for Contractor to provide a system that meets all extents of applicable codes.

B. Contractor shall provide with respect to his design: Certifications, signatures, stamps, seals, etc. by persons, such as technicians, engineers, etc. meeting all qualifications required by codes and authorities having jurisdiction.

C. All remodels shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building.

D. Where a wired communication system is installed as approved by the AHJ, an additional radio system may not be needed upon approval of the AHJ.

E. Contractor shall coordinate radio coverage requirements with the building official and fire code official.

F. The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95 percent of all areas on each floor of the building meet the signal strength requirements.

G. Emergency responder radio coverage systems shall be provided with dedicated standby batteries or provided with 2-hour standby batteries and connected to the facility generator power system. The standby power supply shall be capable of operating the emergency responder radio coverage system at 100 percent system capacity for a duration of not less than 12 hours.

3.6 TESTS AND ADJUSTMENTS

A. Upon completion of the installation phase, test and adjust the system to insure proper operation.

B. Test all operational features of the system at this time.

C. Where required, make appropriate correction(s) and adjustments.

D. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

E. When the installation of all new network fire alarm system components has been completed and prior to scheduling the final inspection for the network, furnish testing equipment and perform the following tests in the presence of the Owner Representative. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meet all contract and regulatory requirements.

F. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

G. Test the insulation on all installed cables and wiring by standard methods as recommended by the equipment manufacturer.

H. The Contractor shall demonstrate transmission of signals across the network.

I. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.

J. Open each alarm initiating and notification circuit to see if the trouble signal actuates.

K. Ground each alarm initiation and notification circuit and verify response of trouble signals.

L. Check alarm transmission to all fire alarm remote network annunciators and to the offsite monitor service.

M. Make final adjustments of all sensing devices.

N. Calibrate all equipment to obtain optimum performance.

O. Tests shall be completed for each defined area of work in a building at the time when the work is completed and the fire alarm system for that area is placed back into service. Testing of notification signals in building areas shall occur between 5:00 pm and 10:00 pm and requires prior approval by the Owner representative.

3.7 FINAL CHECKOUT AND ACCEPTANCE

A. Verify the following before scheduling the system demonstration:
   1. System installation is complete.
   2. System is fully operational.
   3. All tests and adjustments have been completed.

B. Demonstrate the operation and use of the system to the Engineer, to the Owner's representative(s) and the Fire Marshal.

C. Provide a letter to the Owner certifying that the installation is complete, fully operational and successfully tested.

D. Acceptance letter from the Fire Marshall.

E. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days are without a system or equipment malfunction.

F. Instruction and training have been completed.

G. Final acceptance of the system will be given upon completion of all the above requirements.

3.8 INSTRUCTION / TRAINING

A. The manufacturer's authorized representative shall provide instruction and on-site training to the Owner’s staff as follows:

B. Four one-hour sessions for engineering staff, security police and central attendant personnel for simple operation of the system. Two sessions at the completion of installation and two sessions 3 months after the completion of installation.

C. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the entire system for submittal to the Owner. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose-leaf binder. When reading the sequence of operation, the reader will be able to determine what output quickly and easily will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.

D. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

3.9 SYSTEM GUARANTEE

A. Provide a complete parts and labor warranty for the system, commencing on the date of final acceptance and continuing for a period of one (2) year. Provide all materials and labor required to correct any system malfunction or failure (determined not to be the result of negligence, abuse or misuse) at no charge to the Owner during this time period.

3.10 MAINTENANCE

A. Maintain a local service organization which is available to perform testing, inspection, repair, and maintenance service on the system.

B. Make available to the Owner a maintenance contract proposal, from the system supplier to provide a minimum of two (2) inspections and test per year in compliance with NFPA-72 guidelines.

3.11 AS-BUILT DOCUMENTATION

A. Provide to the Engineer two (2) complete as-built manuals assembled in loose-leaf binders containing the following:
   1. As-built system functional block diagrams.
   2. Corrected copies of approved shop drawings
   3. As-built system wiring diagram.
   4. List indicating each device, location, address, label, etc.
   5. Final operating sequence (step by step) for the system as tested and accepted by the Fire Marshal.
   6. Hard copy printout of the complete fire alarm operating program, and a USB drive with programming software as written and customized for this project.
      a. System operation manuals.
      b. System maintenance manuals.

c. Name, address and phone number of the responsible service organization.

END OF SECTION

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SECTION 31 05 16 - AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 RELATED WORK

A. Related work specified in other sections:
   1. Section 31 10 10: Site Clearing
   2. Section 31 22 00: Grading
   3. Section 31 23 33: Trench Excavation and Backfilling for Utilities
   4. Section 31 25 00: Erosion and Sediment Controls
   5. Section 32 12 16: Asphalt Paving
   6. Section 32 13 13: Concrete Paving
   7. Section 33 42 00: Stormwater Conveyance

1.2 SUBMITTALS

A. Submit laboratory test reports indicating the proposed aggregate grading meets the requirements specified herein.

B. Submit laboratory test results indicating the proposed aggregate base material meets the Los Angeles Abrasion requirements, and minimum percent crushed as specified herein.

C. The information must be current and represent the material to be supplied to the project site. If test information is not available from the supplier, the Contractor shall make arrangements and pay for required tests.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Soil materials shall meet the requirements of MnDOT Standard Specifications for Construction, 2020 Edition, Section 3136, Section 3138, Section 3149, and the most current MnDOT special provisions.

B. Provide suitable on-site or off-site borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

C. Refer to Geotechnical Report for fill materials and suitable locations.

D. Topsoil shall be a fertile, friable, natural loam containing a liberal amount of humus and capable of sustaining vigorous plant growth.

E. The pH value of the topsoil shall be between 5.5 and 7.5.

F. Topsoil shall be obtained from naturally well-drained areas and shall be clean and reasonably free of subsoil, stones, clods of hard earth, plants or their roots and other extraneous matter.

G. Topsoil obtained from stripping the site may be used.

H. The topsoil, whether it is new or salvaged, shall be loosened such that it is dry and friable and ready to be fine graded.

PART 3 EXECUTION

NONE THIS SECTION

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing designated paving, curbs, sidewalks, and driveways.
   2. Topsoil excavation, and removal of unsuitable soils.

B. Related Sections:
   1. Section 31 22 00: Grading
   2. Section 31 25 00: Erosion and Sediment Controls

1.2 SUBMITTALS

A. Submit Manufacturer's Certificate certifying products meet or exceed specified requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

A. Perform Work in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2101, 2104, 2106, and the most recent special provisions.

3.2 EXAMINATION

A. Verify existing conditions before starting work.

B. Identify area for placing removed materials.

3.3 PREPARATION

A. Notify Utility Companies prior to performing any Work. Call Gopher State One Call: 1-800-252-1166.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Coordinate any required relocation of underground utilities with utility owner.

3.4 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping as shown in the Plans.

C. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.5 CLEARING AND GRUBBING

A. Execution shall take place as specified in the MnDOT Standard Specifications for Construction, 2020 Edition, Section 2101, and the most recent special provisions, except as modified herein.

B. The Contractor shall remove only those trees necessary to be removed to construct this Project as shown on the Plans or marked by the Engineer prior to removal. All other trees shall be protected from damage during construction.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. The Contractor shall not bury trees, brush, stumps, roots, and other debris or by-products on site.

3.6 MISCELLANEOUS REMOVALS

A. Abandoned structures and other obstructions shall be removed and disposed of in accordance with state and local requirements.

B. Prior to beginning removals, the Engineer or Owner will mark the limits of the features to be removed. The limits shall be reviewed on-site by the Contractor and the Owner's on-site representative.

C. Remove debris, rock, and extracted plant life from site.

D. Partially remove paving, curbs, sidewalks, and driveways as indicated on Drawings. Neatly saw cut edges at right angle to surface.

E. Items indicated to be salvaged shall be done so with minimum damage and stored until reinstallation or moved to a storage location as directed by the Owner.

F. Any item removed that is not to be salvaged or reused on the project shall be disposed of offsite by the Contractor in accordance with state and local requirements.

G. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

H. Conduct removal of waste materials as to minimize interference with vehicular and pedestrian traffic.

I. Do not burn or bury materials on site. Leave site in clean condition.

3.7 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile topsoil to be reused on-site in area determined by the Contractor and approved by the Owner.

D. Protect stockpiled topsoil from erosion in accordance with NPDES permit requirements.

E. Excess topsoil not intended for reuse shall be disposed of off-site if a site for excess topsoil is not identified in the plans.

END OF SECTION

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Geotextiles.
2. Controlled low-strength material.
3. Geofoam.
4. Warning tape.

B. Related Requirements:

1. [**Section 013200 "Construction Progress Documentation"**][**Section 013233 "Photographic Documentation"**] for recording preexcavation and earth-moving progress.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping [**and stockpiling**] topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Section 316329 "Drilled Concrete Piers and Shafts" for excavation of shafts and disposal of surplus excavated material.
5. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
6. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. [**24 inches**]<**Insert dimension**> outside of concrete forms other than at footings.
2. [**12 inches**]<**Insert dimension**> outside of concrete forms at footings.
3. [**6 inches**]<**Insert dimension**> outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. [**6 inches**]<**Insert dimension**> beneath bottom of concrete slabs-on-grade.
6. [**6 inches**]<**Insert dimension**> beneath pipe in trenches, and the greater of [**24 inches**]<**Insert dimension**> wider than pipe or [**42 inches**]<**Insert dimension**> wide.

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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: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for [**unit prices**][**changes in the Work**].
2. Bulk Excavation: Excavation more than [**10 feet**]<**Insert dimension**> in width and more than [**30 feet**]<**Insert dimension**> 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, will be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock:

1. Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed [**1 cu. yd.**]<**Insert volume**> for bulk excavation or [**3/4 cu. yd.**]<**Insert volume**> 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:

a. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a **42-inch-** maximum-width, short-tip-radius rock bucket; rated at not less than **138-hp** flywheel power with bucket-curling force of not less than **28,700 lbf** and stick-crowd force of not less than **18,400 lbf** with extra-long reach boom.
b. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than **230-hp** flywheel power and developing a minimum of **47,992-lbf** breakout force with a general-purpose bare bucket.

2. Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material [**3/4 cu. yd.**]<**Insert volume**> or more in volume that exceed a standard penetration resistance of [**100 blows/2 inches**]<**Insert value**> when tested by a geotechnical testing agency, according to ASTM D1586.

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I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at [**Project site**]<**Insert location**>.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.
c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
d. Extent of trenching by hand or with air spade.
e. Field quality control.
f. <**Insert agenda items**>.

1.5 ACTION SUBMITTALS

A. Product Data: For each type product.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: **12 by 12 inches**.
2. Warning Tape: **12 inches** long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each [**on-site**][**and**][**borrow**] soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to [**ASTM D698**][**ASTM D1557**].

C. Blasting plan [**approved by authorities having jurisdiction**].

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D. Seismic survey report from seismic survey agency.

E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 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: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving 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. Utility Locator Service: Notify [**utility locator service**][**"Miss Utility"**][**"Call Before You Dig"**][**"Dig Safe System"**][**"One Call"**]<**Insert name**> for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in [**Section 015000 "Temporary Facilities and Controls"**][**and**][**Section 311000 "Site Clearing"**] are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639

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"Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

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: Soil Classification [**Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487**][**Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145**], or a combination of these groups; free of rock or gravel larger than [**3 inches**]<**Insert dimension**> in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: <**Insert value**>.
2. Plasticity Index: <**Insert value**>.

C. Unsatisfactory Soils: Soil Classification [**Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487**][**Groups 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 D2940/D2940M; 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 D2940/D2940M; with at least 95 percent passing a **1-1/2-inch** sieve and not more than 8 percent passing a **No. 200** sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a **1-1/2-inch** sieve and not more than 12 percent passing a **No. 200** sieve.

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G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a **1-inch** sieve and not more than 8 percent passing a **No. 200** sieve.

H. Drainage Course: Narrowly graded mixture of [**washed**] crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a **1-1/2-inch** sieve and zero 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 D448; coarse-aggregate grading Size 67; with 100 percent passing a **1-inch** sieve and zero to 5 percent passing a **No. 4** sieve.

J. Sand: ASTM C33/C33M; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability:

a. Class 2; AASHTO M 288.
b. As follows:

1) Grab Tensile Strength: **157 lbf**; ASTM D4632.
2) Sewn Seam Strength: **142 lbf**; ASTM D4632.
3) Tear Strength: **56 lbf**; ASTM D4533.
4) Puncture Strength: **56 lbf**; ASTM D4833.

c. Apparent Opening Size: [**No. 40**][**No. 60**][**No. 70**] sieve, maximum; ASTM D4751.
d. Permittivity: [**0.5**][**0.2**][**0.1**] per second, minimum; ASTM D4491.
e. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability:

a. Class 2; AASHTO M 288.
b. As follows:

1) Grab Tensile Strength: **247 lbf**; ASTM D4632.
2) Sewn Seam Strength: **222 lbf**; ASTM D4632.
3) Tear Strength: **90 lbf**; ASTM D4533.
4) Puncture Strength: **90 lbf**; ASTM D4833.

c. Apparent Opening Size: **No. 60** sieve, maximum; ASTM D4751.

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d. Permittivity: 0.02 per second, minimum; ASTM D4491.
e. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting [**, cellular, low-density**], flowable concrete material produced from the following:

1. Portland Cement: ASTM C150/C150M, [**Type I**][**Type II**][**or**][**Type III**].
2. Fly Ash: ASTM C618, Class C or F.
3. Normal-Weight Aggregate: ASTM C33/C33M, [**3/4-inch**][**3/8-inch**]<**Insert dimension**> nominal maximum aggregate size.
4. Foaming Agent: ASTM C869/C869M.
5. Water: ASTM C94/C94M.
6. Air-Entraining Admixture: ASTM C260/C260M.

B. Produce cellular, low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: [**30 to 36 lb/cu. ft.**][**36 to 42 lb/cu. ft.**]<**Insert unit weight range**> at point of placement, when tested according to ASTM C138/C138M.
2. Compressive Strength: [**80 psi**][**140 psi**]<**Insert value**>, when tested according to ASTM C495/C495M.

C. Produce conventional-weight, controlled low-strength material with [**80-psi**][**140-psi**]<**Insert value**> compressive strength when tested according to ASTM C495/C495M.

2.4 GEOFOAM

A. Extruded-Polystyrene Board Insulation: ASTM C578, [**Type IV, 1.55-lb/cu. ft. density, 25-psi compressive strength**][**Type X, 1.30-lb/cu. ft. density, 15-psi compressive strength**][**Type VI, 1.80-lb/cu. ft. density, 40-psi compressive strength**][**Type VII, 2.20-lb/cu. ft. density, 60-psi compressive strength**][**Type V, 3.00-lb/cu. ft. density, 100-psi compressive strength**].

B. Molded-Polystyrene Board Insulation: ASTM C578, [**Type I, 0.90-lb/cu. ft. density, 10-psi compressive strength**][**Type VIII, 1.15-lb/cu. ft. density, 13-psi compressive strength**][**Type II, 1.35-lb/cu. ft. density, 15-psi compressive strength**].

1. Manufacture molded polystyrene with an inorganic mineral registered with the EPA and suitable for application as a termite deterrent.

C. Rigid Cellular Polystyrene Geofoam: ASTM D6817, [**Type EPS 19, 1.15-lb/cu. ft. density, 5.8-psi compressive strength at 1 percent deformation; 16-psi compressive strength at 10 percent deformation**][**Type EPS 39, 2.40-lb/cu. ft. density, 15-psi compressive strength at 1 percent deformation; 40-psi compressive strength at 10 percent deformation**]<**Insert requirement**>.

D. Connectors: [**Geofoam manufacturer's multibarbed, galvanized-steel sheet connectors**][**Deformed steel reinforcing bars, 3/4 inch in diameter**]<**Insert requirement**>.

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2.5 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, **6 inches** wide and **4 mils** thick, continuously inscribed with a description of the utility; colored as follows:

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.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of **6 inches** wide and **4 mils** thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to **30 inches** deep; colored as follows:

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 earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. 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

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excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives:

1. Do not use explosives.
2. Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

    a. Perform blasting without damaging adjacent structures, property, or site improvements.
    b. 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**]<**Insert dimension**> outside of concrete forms other than at footings.
    b. [**12 inches**]<**Insert dimension**> outside of concrete forms at footings.
    c. [**6 inches**]<**Insert dimension**> 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**]<**Insert dimension**> beneath bottom of concrete slabs-on-grade.
    f. [**6 inches**]<**Insert dimension**> beneath pipe in trenches and the greater of [**24 inches**]<**Insert dimension**> wider than pipe or [**42 inches**]<**Insert dimension**> wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not

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classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

   a. [**24 inches**]<**Insert dimension**> outside of concrete forms other than at footings.
   b. [**12 inches**]<**Insert dimension**> outside of concrete forms at footings.
   c. [**6 inches**]<**Insert dimension**> 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**]<**Insert dimension**> beneath bottom of concrete slabs-on-grade.
   f. [**6 inches**]<**Insert dimension**> beneath pipe in trenches and the greater of [**24 inches**]<**Insert dimension**> wider than pipe or [**42 inches**]<**Insert dimension**> 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.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

   1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

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.

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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**][**As indicated**].

C. Trench Bottoms:

1. 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.

a. For pipes and conduit less than **6 inches** in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
b. For pipes and conduit **6 inches** or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
d. Excavate trenches **6 inches** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

2. Excavate trenches **4 inches** deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

a. Excavate trenches **6 inches** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 EXCAVATION FOR ELEVATOR CYLINDER

A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in [**Section 142400 "Hydraulic Elevators."**][**Section 142413 "Hydraulic Freight Elevators."**]

B. Provide well casing as necessary to retain walls of well hole.

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3.9 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**]<**Insert locations**> with a pneumatic-tired [**and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons**]<**Insert requirement**> 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. 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**][**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.

3.10 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, pipe, or conduit as directed by Architect.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 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, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

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B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 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. Trenches under Footings: Backfill trenches excavated under footings and within [**18 inches**]<**Insert dimension**> of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide [**4-inch-**]<**Insert dimension**> thick, concrete-base slab support for piping or conduit less than [**30 inches**]<**Insert dimension**> below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of [**4 inches**]<**Insert dimension**> of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of [**subbase material**][**satisfactory soil**], free of particles larger than [**1 inch**]<**Insert dimension**> in any dimension, to a height of **12 inches** over the pipe or conduit.

    a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of **12 inches** over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, **12 inches** below finished grade, except **6 inches** below subgrade under pavements and slabs.

3.14 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:

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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.

3.15 GEOFOAM FILL

A. Place a leveling course of sand, [**2 inches**]<**Insert dimension**> thick, over subgrade. Finish leveling course to a tolerance of **1/2 inch** when tested with a **10-foot** straightedge.

1. Place leveling course on subgrades free of mud, frost, snow, or ice.

B. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.

C. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.

D. Cover geofoam with [**subdrainage**][**separation**] geotextile before placing overlying soil materials.

3.16 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.

3.17 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than [**8 inches**]<**Insert dimension**> in loose depth for material compacted by heavy compaction equipment and not more than **4 inches** in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to [**ASTM D698**][**ASTM D1557**]:

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**]<**Insert number**> percent.
2. Under walkways, scarify and recompact top **6 inches** below subgrade and compact each layer of backfill or fill soil material at [**92**]<**Insert number**> percent.

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3. Under turf or unpaved areas, scarify and recompact top **6 inches** below subgrade and compact each layer of backfill or fill soil material at [**85**]<**Insert number**> percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at [**85**]<**Insert number**> percent.

3.18 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus [**1 inch**]<**Insert dimension**>.
2. Walks: Plus or minus [**1 inch**]<**Insert dimension**>.
3. Pavements: Plus or minus [**1/2 inch**]<**Insert dimension**>.

C. Grading inside Building Lines: Finish subgrade to a tolerance of [**1/2 inch**]<**Insert dimension**> when tested with a **10-foot** straightedge.

3.19 SUBSURFACE DRAINAGE

A. 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 D698**][**with a minimum of two passes of a plate-type vibratory compactor**].

B. 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 one 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 D698**][**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.

3.20 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course [**and base course**] on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course [**and base course**] under pavements and walks as follows:

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1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course [**and base course**] to required crown elevations and cross-slope grades.
4. Place subbase course [**and base course**] **6 inches** or less in compacted thickness in a single layer.
5. Place subbase course [**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 course [**and base course**] at optimum moisture content to required grades, lines, cross sections, and thickness to not less than [**95**]<**Insert number**> percent of maximum dry unit weight according to [**ASTM D698**][**ASTM D1557**].

C. Pavement Shoulders: Place shoulders along edges of subbase course [**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**]<**Insert number**> percent of maximum dry unit weight according to [**ASTM D698**][**ASTM D1557**].

3.21 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

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**]<**Insert number**> percent of maximum dry unit weight according to ASTM D698.

3.22 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
4. <**Insert special inspections**>.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with

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requirements.

D. 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.

E. Compaction Testing: Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every [**2000 sq. ft.**]<**Insert area**> or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every [**100 feet**]<**Insert dimension**> or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every [**150 feet**]<**Insert dimension**> or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.23 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.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

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END OF SECTION 312000

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SECTION 312001 - EARTH MOVING WITHIN BUILDING FOOTPRINT

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. Preparing subgrades for slabs-on-grade [Excavating and backfilling for buildings and structures.
   2. Drainage course for concrete slabs-on-grade.
   3. Subsurface drainage backfill for walls and trenches.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices." Provide Unit Prices for the following:
   1. Overexcavation ($/cu. yd.)
   2. Backfill using on-site material ($/cu. yd)
   3. Backfill using borrow material ($/cu. yd)

1.4 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. 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.**
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation shall be without additional compensation.

D. Fill: Soil materials used to raise existing grades.

E. 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.

F. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

G. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698 .

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Preexcavation Conference: Conduct conference at Project site .

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

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: Refer to the November 14, 2025 Chosen Valley Testing Geotechnical Report.Retain subparagraphs below if required to further qualify satisfactory soil groups.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 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. Engineered Fill: Suitable fill material as defined in the November 14, 2025 Chosen Valley Testing Geotechnical Report. .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. Sand: ASTM C 33; fine aggregate.

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 earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 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.

3.3 EXCAVATION, GENERAL

A. Classified Excavation: Excavate to subgrade elevations.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Coordinate trench excavation with aggregate pier specification.

2. 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, joi

D. ts, 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, 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 or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. Notify Geotechnical Engineer when excavations have reached required subgrade.

B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices .

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 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.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.
3. Under building slabs, use engineered fill.
4. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in compacted layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers in accordance with the November 14, 2025 Chosen Valley Testing Geotechnical Report. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

B. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 :

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 (100 percent within 3’ of footing or slab bearing and as indicated in the Geotechnical Report.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform special tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. 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 Engineer.

E. 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 one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.15 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 Engineer; 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.

3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 22 00 - GRADING

PART 1 GENERAL

1.1 RELATED WORK

A. Related work specified in other sections:
   1. Section 31 05 16: Aggregates for Earthwork
   2. Section 31 10 00: Site Clearing
   3. Section 31 23 33: Trench Excavation and Backfilling for Utilities
   4. Section 31 25 00: Erosion and Sediment Controls
   5. Section 32 12 16: Asphalt Paving
   6. Section 32 13 13: Concrete Paving
   7. Section 33 42 00: Stormwater Conveyance

1.2 SUMMARY

A. Preparing subgrades for buildings, slabs, walks, concrete/bituminous pavements and other exterior improvements.

B. The extent of grading is shown on the Drawings.

1.3 REFERENCES

A. Geotechnical Evaluation Report as contained in the Project Manual.

1.4 JOB CONDITIONS

A. All information concerning property boundaries, ground elevations, present obstructions on or near the site, location of conduits, pipes, wires, etc., has been obtained from a source the Owner believes reliable. Present ground and subsurface conditions are documented by test boring logs included herein, however accuracy of this data is not guaranteed, and is furnished solely for the convenience of the Bidder. Use of this data is at Bidder's risk and no additional compensation will be granted because of the Bidder's lack of knowledge of the existing site.

B. Additional test borings and other exploratory operations may be conducted by a Bidder (at no cost to the Owner), provided the methods and operations are acceptable to the Owner.

C. Grades shown on the Plans are finished grades. Grading Contractor shall grade to the subgrade except landscaped areas that will be graded to finish grade with approved topsoil.

D. The Contractor shall be solely responsible for determining quantities of cut, fill and waste materials and for the amount of grading to be done to complete the Work. Import/Export materials as required at no additional cost to the Owner.

E. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult appropriate utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair any damaged utility(s) to satisfaction of utility owner.

F. Visit the site prior to bidding; be familiar with actual conditions in the field. Extra compensation will not be allowed for conditions which could have been determined or anticipated by examination of the site, the Contract Drawings and the information available pertaining to existing soils, utilities and other site characteristics.

G. Maintain carefully, as established, temporary bench marks, monuments and other reference points and, if disturbed or destroyed by the Contractor, pay for replacement by a registered Engineer or Land Surveyor.

H. Locate existing underground utilities andtile lines in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

1.5 QUALITY ASSURANCE

A. A soil testing and inspection service (Geotechnical Engineer) will perform quality control testing of the earthwork operations.

B. Contractor shall coordinate with the soil testing and inspection service to provide samples, a grading schedule, and equipment and personnel to perform the necessary tests.

PART 2 PRODUCTS

2.1 SOIL SEPARATION FABRIC

A. Highly permeable non-woven fabric with a random arrangement of fibers heat bonded at crossover points, or spun bonded and mechanically entangled by needle punching or other acceptable methods, with the following properties.

Apparent Opening Size, ASTM D4751	USS #100 maximum
Minimum Weight	3.7 oz/sq. yd.
GrabTensile Strength, ASTM D4632	180lb. minimum each direction
Bursting Strength, ASTM D3786	330 psi minimum
Grab Tensile Elongation %, ASTM D4632	50 maximum each direction
Flow Rate, ASTM D4491	105 gal/min/ft² Minimum

B. The fabric shall readily conform to the soil surface.

PART 3 EXECUTION

3.1 GENERAL

A. Perform work in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2106, Section 2112, and the most recent special provisions except as modified herein.

3.2 EXAMINATION

A. Verify existing conditions before starting work.

B. Identify area for placing removed materials.

3.3 PREPARATION

A. Notify Utility Companies prior to performing any Work. Call Gopher State One Call: 1-800-252-1166.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Coordinate any required relocation of underground utilities with utility owner.

B. Identify required lines, levels, contours, and datum.

C. Notify utility companies of any utilities that need to be relocated, removed or worked around.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.4 EXCAVATION

A. Perform excavations as necessary to accomplish the intent of the Contract Documents.

B. Excavations shall be perfomed in accordance with the recommendations contained in the Geotechnical Report.

C. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches."

D. Remove topsoil in areas to be regraded and/or excavated without mixing with existing subgrade soils. Stockpile salvaged topsoil that will be reused.

E. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

F. Remove excess subsoil not intended for reuse, from site.

G. Excess materials or materials not to be reused on-site shall be disposed of off-site in accordance with state and local requirements.

H. Stockpile excavated material to be reused on site in area agreed upon by the Owner/Engineer.

I. Review all subgrades with the Geotechnical Engineer to determine suitability of subgrade soils.

J. Test roll all proposed pavement areas with a fully loaded tandem-axle truck and have test rolling observed by Geotechnical Engineer prior to placement of placement of additional fill or aggregate base.

K. Subgrade under building footprints shall be held down below finished floor. Refer to Structural Drawings and specifications for requirements.

L. When subgrades consist of SP soils, test rolling shall not be conducted until after placement of the aggregate base. Confirm presence of SP soils with Geotechnical Engineer.

M. Remove any groundwater and/or accumulated water from excavations or subgrades prior to fill placement or construction.

N. Provide temporary drainage where construction interferes with existing drainage.

O. Where new sod, seed, planting beds, or other vegetative matter are shown within construction limits defined on drawings, remove existing fill soil material to depth required for topsoil and replace with new or salvaged topsoil material.

P. Do not remove topsoil when wet.

Q. Make soil corrections defined in the Geotechnical Report. Follow soil correction procedures and use materials defined in the Report and in these specifications.

R. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

S. When excavating through roots, perform work by hand and cut roots with sharp axe.

T. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

U. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.5 SOIL CORRECTION

A. Unsuitable soils as identified by the soil borings and the Geotechnical Engineer onsite must be removed and included in the base bid. Geotechnical engineer will give extents of removal, and approve removal of unsuitable soils before filling commences.

B. For bidding purposes, the Contractor shall include the soil corrections as detailed in the geotechnical report in their bid.

C. Any soil corrections beyond those identified in the geotechnical report and approved by the Engineer and Geotechnical Engineer will be paid for through a change order based on the unit price provided on the bid form.

D. The unit price shall include all labor, equipment and materials necessary to remove unsuitable soils and replace them with suitable material identified in the plans and specifications.

E. Soil correction in-place volume will be determined by the following methodology.
   1. Upper limit of the subgrade of the elevation shall be defined as:
      a. The bottom of the subgrade.
   2. A Land Surveyor will survey subgrade areas determined to contain unsuitable soils.
   3. Contractor will remove unsuitable soils while coordinating removal extents with Geotechnical Engineer.
   4. Land Surveyor will survey bottom of of excavation with appropriate overlap.
   5. Contractor shall fill excavation using suitable materials, following the execution contained in this specification, and in a manner to suppor exterior improvement.
   6. In-place volume calculations will be performed by comparing the subgrade surface with the excavated surface.

F. Soil correction in-place volume will be tabulated throughout the grading activities and compared with base-bid quantities. Volume calculation and tabulation will be performed by the Land Surveyor.

G. In areas where excavation is required to achieve subgrade elevation, Contractor shall notify Geotechnical Engineer when excavation has achieved subgrade elevation.

H. Geotechnical Engineer shall determine subgrade soil suitability for the exterior improvement it will be supporting by any combination of visual analysis, sampling, and proof rolling necessary.

I. Contractor shall provide labor and equipment necessary to support determination of soil suitability and soil correction areas. The Contractor shall allow time for this work to occur and shall coordinate this work with the Geotechnical Engineer.

3.6 PLACEMENT AND COMPACTION

A. Place fill and prepare subgrades according to the recommendations contained in the Geotechnical Report and in these specifications.

B. In areas that will receive fills, remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.

C. Prior to placement of fill, excavations shall be inspected by the Geotechnical Engineer to verify that all unsuitable materials have been properly removed.

D. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

E. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

F. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

G. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Testing Agency if soil density tests indicate inadequate compaction.

H. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations. (This material is not acceptable for building fill).
   1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
   2. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

I. In paved areas the exposed subgrade shall be scarified to a depth of 8", blended, moisture conditioned to within moisture allowable moisture variance.

J. All proposed pavement areas shall be test rolled in accordance with MnDOT 2111 subsequent to finish grading in the presence of the Geotechnical Engineer.

K. Rough grade tolerances are as follows. Contractor shall be responsible for determining final grades with laser-guided equipment or survey. Subgrade elevations are subject to confirmation by the Land Surveyor.
   1. All building areas and areas to be paved shall be brought to within 0.10' of subgrade elevations and cross sections.
   2. Unpaved areas: Not more than 0.15' above or below finish grade elevations shown on the drawings.

L. The subgrade shall reflect the same grade (percent slope) as the finish grade to ensure a consistent depth of topsoil or pavement section.

3.7 COMPACTION DENSITY REQUIREMENTS

A. Allow Geotechnical Engineer 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.

B. See Geotechnical Report for compaction requirements for fill and backfill.

C. Field Density Test Report shall clearly identify the following information for each test:
   1. Horizontal and vertical location of test.
   2. Material type being tested.
   3. Proctor test method.
   4. Maximum proctor density.
   5. Specified density.
   6. Optimum moisture density.
   7. Field test method.
   8. Actual moisture content.
   9. Actual dry density.
   10. Pass/fail indication.

D. 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. Consult Project Geotechnical Engineer for additional or supplemental recommendations.

3.8 SOIL SEPARATION FABRIC

A. Excavate to the dimensions shown on the drawings.

B. The foundation surface shall be relatively smooth and free of stones, sticks, and other debris or irregularities that might puncture the fabric.

C. Line the excavation with the fabric. Overlap splices and joints a minimum of 18 inches. Joint laps shall be shingled (both in flow direction and from top of slope to bottom) to direct water flow over the joint without undermining.

D. Place the aggregate over the fabric in lifts and compact. Placement of granular material and other construction operations shall not tear, puncture, or shift the fabric.

E. Overlap the edge of the fabric over the top of the aggregate a minimum of 12 inches.

3.9 FINAL GRADING

A. Building and paved areas shall be final graded as follows:
   1. All areas to be paved shall be brought to within 1/10 if a foot of subgrade elevations and cross sections. Uniformly slope the subexcavation bottoms to coincide with the proposed surface grades. Blade subexcavation to a smooth surface prior to proof roll.
      a. The Contractor shall compact and shape the subgrade for its entirety as may be necessary to produce the specified density and stability in the top 12 inches of the subgrade and the grades shown on the Drawings.

B. Turf areas shall be final graded as follows:
   1. Turf areas are defined as any area not covered by asphalt, concrete, building, aggregates, infiltration basins and bioretention basins.
   2. In turf areas, spread topsoil material to a minimum depth of 6 inches and a maximum depth of 12 inches (depth after compaction), subsequent to installation of pavements,

fencing, and walks. Complete grading of site and bring entire site to finish elevations shown on drawings. General turf areas shall be bladed smooth with a skid steer, planer bar, or similar lightweight equipment.

3. Compact the subsoil and topsoil as necessary to prevent future settlement without inhibiting vertical drainage and subsequent turf establishment.
4. If over compaction occurs (defined as a relative density above 90% Standard Proctor density), the Contractor shall scarify the soil to full depth of topsoil and regrade as required.
5. Turf area grade tolerance shall be not more than 0.08' (one inch) above or below finish grade elevations.
6. Final grading of topsoil shall be accomplished immediately prior to turning over to the sodding/seeding contractors. Coordinate finish grading with landscaping contractor's schedule.
7. Topsoil shall not be spread around the building until exterior building work (any work related to building exterior finishing that would cause disturbance to the topsoil after it is placed) is complete.
8. Topsoil shall not be backfilled behind back of curb, pavements or walks until curbing, pavements and walks are installed.
9. Topsoil shall not be spread until underground utilities (storm sewer, sanitary sewer and watermain) are installed.

C. Protect newly graded areas from traffic and erosion. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances to the satisfaction of the Engineer.

D. Maintenance of the full site shall be accomplished by this Contract until final project completion.

END OF SECTION

SECTION 31 23 33 - TRENCH EXCAVATION AND BACKFILLING FOR UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating trenches for utilities.
   2. Compacted fill from top of utility bedding to subgrade elevations.
   3. Backfilling and compaction.

1.2 RELATED SECTIONS:

A. Section 33 14 00: Water Distribution Piping

B. Section 33 31 00: Sanitary Sewerage Piping

C. Section 33 32 11: Wastewater Pumping Stations

D. Section 33 42 00: Stormwater Conveyance

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Structure: Any hydrant, curb stop, gate valve, manhole, cleanout or catch basin.

1.4 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

C. Product Data: Submit a sieve analysis of borrow material; granular, crushed rock or any imported materials, to be used on the project prior to use of the material on the project.

D. Materials Source: Submit name of imported fill materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.6 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 GRANULAR BORROW

A. Granular borrow for use as bedding or fill material shall be “granular bedding” in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 3149, and the most recent special provisions.

2.2 CRUSHED ROCK

A. Crushed rock for use as bedding or fill material shall be “coarse filter aggregate” in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 3149, and the most recent special provisions.

PART 3 EXECUTION

3.1 GENERAL

A. Execution shall be in accordance with the State Plumbing Code, local jurisdiction requirements, and as shown in the plans except as modified herein.

3.2 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.3 PREPARATION

A. Notify Utility Companies prior to performing any Work. Call Gopher State One Call: 1-800-252-1166.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Coordinate any required relocation of underground utilities with utility owner.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

G. Excavations in excess of 20 feet shall be designed by a licensed Engineer and a copy of this design shall be forwarded to the Engineer for their records.

3.4 TRENCHING

A. All excavations and trenches must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, “Excavations and Trenches”.

B. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard measured by volume.

C. Do not advance open trench more than 200 feet ahead of installed pipe.

D. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.

E. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and utilities.

F. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered and fill with granular or crushed rock material.

G. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

H. Excavated non-organic materials shall be salvaged and stockpiled for use as subgrade materials and for the replacement of any unsuitable materials encountered during utility installation.

I. Excess non-organic materials not used for subgrade materials or for the replacement of unsuitable materials shall be removed from site.

3.5 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.6 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. No stones exceeding 6 inches in greatest dimension will be permitted in the upper 3 feet of the roadbed embankment.

C. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

D. Place fill material in continuous layers and compact in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2106, and the most recent special provisions.

E. Compaction of all trench backfill shall be obtained by the “Specified Density Compaction” method described in MnDOT 2106.3G.1 unless specified otherwise in these specifications.
   1. The upper 3 feet of fill and fill that is adjacent to structures shall be compacted to a density of not less than 100 percent of maximum density.
   2. Fill below the upper 3 feet and not adjacent to structures shall be compacted to a density of not less than 95% of maximum density.

F. The Contractor shall coordinate backfilling operations with the Owner/Engineer for the scheduling of testing for compaction.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. The Contractor shall scarify, dry the backfill material, or apply water as may be necessary to obtain the required density and stability.

I. In order to prevent future settlement of roads, lawns, driveways, and utilities, the Contractor shall compact uniformly and entirely, careful not to omit any areas.

J. Do not leave trench open at end of working day.

K. Protect open trench to prevent danger to the public.

3.7 TOLERANCES

A. Top Surface of Backfilling under paved areas: Plus or minus 1/4 inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1inch from required elevations.

3.8 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction

END OF SECTION

SECTION 31 25 00 - EROSION AND SEDIMENT CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Erosion Control.
   2. Sediment Control.
   3. Maintenance during Construction.
   4. Air, Land and Water Pollution.
   5. NPDES Permits.

B. Related Sections:
   1. Section 31 10 00: Site Clearing
   2. Section 31 22 00: Grading
   3. Section 31 23 33: Trench Excavation and Backfilling for Utilities

PART 2 PRODUCTS

2.1 GENERAL

A. Materials shall be as specified in MnDOT Standard Specifications for Construction – 2020 Edition, Section 2573 and 2575.

PART 3 EXECUTION

3.1 GENERAL

A. Execution shall be as specified in MnDOT Standard Specifications for Construction – 2020 Edition, Section 2573, MnDOT Special Provisions and as shown on the Drawings except as modified herein.

B. The General and Supplemental specifications shall take precedence in resolving any conflict, error, etc. between the Contract Documents and any standard, specification, manual, code or instruction.

C. The Contractor shall protect adjacent properties and water resources from erosion and sedimentation damage throughout construction.

D. The Contractor shall notify the Engineer and Construction Manager of deficiencies or changes in the Erosion Control Plans or SWPPP required by current or changes to site conditions.

E. The Contractor shall schedule and conduct operations to minimize the erosion of soils, to prevent the transportation of silt within and adjacent to the site.

F. Construction of drainage infrastructure and the establishment of turf shall be done concurrently with earthwork operations or soon thereafter to minimize erosion and the transportation of sediment.

G. The Contractor shall incorporate erosion control features as soon as practicable prior to grading operations and provide additional control measures as needed to correct conditions that develop during construction.

3.2 MAINTENANCE DURING CONSTRUCTION

A. Execution shall be as specified in MnDOT Standard Specifications for Construction – 2020 Edition, Section 1514 except as modified herein.

B. In addition to the Contractor's requirements for sweeping as required under MnDOT 2051 (Maintenance and Restoration of Haul Roads), the Engineer may require additional sweeping of roads adjacent to the construction site to provide safe conditions for the traveling public, for environmental reasons, to meet local regulatory requirements or as otherwise directed by the Owner.

C. All erosion control devices shall remain in place until other means of permanent control are in place.

D. Contractor shall maintain erosion control devices throughout construction and replace them when they no longer function properly.

E. Erosion control devices shall not be removed until the site has been permanently stabilized in accordance with NPDES permit requirements.

3.3 AIR, LAND, AND WATER POLLUTION

A. Execution shall be as specified in MnDOT Standard Specifications for Construction – 2020 Edition, Section 1717 and as shown on the Drawings except as modified herein.

B. If during the course of the Project, the Contractor unexpectedly encounters any of the following conditions indicating the possible presence of contaminated soil, contaminated water, or regulated waste, the Contractor shall immediately stop work in the vicinity, notify the Engineer, and request suspension of work in the vicinity of the discovery area, in accordance with MnDOT 1803.4.

C. A documented inspection and evaluation will be conducted prior to the resumption of work. The Contractor shall not resume work in the suspected area without authorization by the Owner's representative.
   1. Indicators of contaminated soil, ground water or surface water include, but are not limited to the following:
      a. Odor including gasoline, diesel, creosote (odor of railroad ties), mothballs, or other chemical odor.
      b. Soil stained green or black (but not because of organic content), or with a dark, oily appearance, or any unusual soil color or texture.
      c. A rainbow color (sheen) on surface water or soil.
   2. Indicators of regulated wastes include, but are not limited to the following:
      a. Cans, bottles, glass, scrap metal, wood (indicators of solid waste and a possible dump)
      b. Concrete and asphalt rubble (indicators of demolition waste).
      c. Roofing materials, shingles, siding, vermiculite, floor tiles, transite or any fibrous material (indicators of demolition waste that could contain asbestos, lead or other chemicals).
      d. Culverts or other pipes with tar-like coating, insulation or transite (indicators of asbestos).
      e. Ash (ash from burning of regulated materials may contain lead, asbestos or other chemicals).
      f. Sandblast residue (could contain lead).

g. Treated wood including, but not limited to products referred to as green treat, brown treat and creosote (treated wood disposal is regulated).
h. Chemical containers such as storage tanks, drums, filters and other containers (possible sources of chemical contaminants).
i. Old basements with intact floor tiles or insulation (could contain asbestos), sumps (could contain chemical waste), waste traps (could contain oily wastes) and cesspools (could contain chemical or oily wastes).

3.4 NPDES PERMITS

A. Execution shall be in accordance with the rules, regulations, and standards adopted and established by the Minnesota Pollution Control Agency (M.P.C.A.), and as specified in MnDOT Standard Specifications for Construction – 2020 Edition, Section 1717 except as modified herein.

B. By signing the Proposal and completing the NPDES permit application, the Contractor is a co-permitee with the Owner to ensure compliance with the terms and conditions of the General Storm Water Permit (MN R100001) and is responsible for those portions of the permit where the operator is referenced. This Permit establishes conditions for discharging storm water to waters of the State from construction activities that disturb 0.4 hectares [**1 acre**] or more of total land area. A copy of the "General Permit Authorization to Discharge Storm Water Associated with a Construction Activity Under the National Pollutant Discharge Elimination System (NPDES)/State Disposal System Permit Program" is available at http://www.pca.state.mn.us/water/stormwater/stormwater-c.html or by calling 651-296-3890.

C. The Owner will provide the Contractor with the application form with Sections 1 thru 3 and 5 thru 14 completed, as part of the Contract document package. The Contractor shall fill out the Contractor's portion (Section 4 and Section 15), complete the application process, and post the Permit and MPCA's letter of coverage onsite.

D. A NPDES Permit Declaration form will be sent to the Contractor with the Contract award packet. A copy of the signed permit application and a signed Permit Declaration form must be returned with the Contract and Bond. Submittal of the copy of the signed permit application and Permit Declaration is mandatory for Contract approval. No work which disturbs soil and/or work in waters of the state will be allowed on this Project until the NPDES Permit is in effect and the Department has received the required documentation.

E. Contractor must provide an Erosion Control Supervisor as per MnDOT 2573.3. The Contractor is solely responsible for all inspections, maintenance, and records required in the General Permit, Section 11. Contractor must use standard forms for logging all required inspection and maintenance activities. Contractor must submit all inspection and maintenance forms used on this Project to the Engineer weekly for retention in accordance with the permit. The Contractor must also have the forms available for on-site review.

F. Contractor must immediately notify the Engineer of any site visits by Local Permitting Authorities performed in accordance with Section 24.10 of the permit. The Contractor must obtain the Engineer’s approval before starting any work required by regulatory authorities which (1) the Contractor believes will result in additional compensation; or (2) will impact the design or requirements of the Contract documents or impact traffic.

G. The Contractor must use Emergency Best Management Practices to help minimize turbidity of surface waters and relieve runoff from extreme weather events. The Contractor must report a stormwater sediment release from the project site to the Minnesota Duty Officer and the Resident Engineer at the time the Contractor or Department discovers the release. The Contractor must also immediately contact the State Duty Officer (at 1-800-422-0798 or 1-651-649-5451) during any emergency situation involving an uncontrolled stormwater release.

H. Contractor must Review and abide by the instructions contained in the permit package. The Contractor will indemnify and hold the Owner harmless for any fines or sanctions imposed by a regulatory authority and arising from the Contractor's acts or omissions in complying, or failing to comply, with the permit or erosion control provisions of this Contract.

I. The NPDES Permit refers to a Storm Water Pollution Prevention Plan (SWPPP). This Project's SWPPP requirement is addressed throughout the Contract, as well as this Project's Plan. The following table identifies NPDES permit requirements and cross-references where this Contract addresses each requirement. This table is for ease of reference only and may be incomplete.

NPDES Permit Requirements	Cross-Reference within this Contract
Obtain NPDES Permit; Permit Compliance; Submit Notice of Termination	MnDOT 1701, 1702; and 1717 Special Provisions: 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)
Certified Personnel in Erosion / Sediment Control Site Management Develop a Chain of Command	MnDOT 1506, 1717, and 2573; Special Provisions: 1717 (Air, Land & Water Pollution), and 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)
Project / Weekly Schedule (for Erosion / Sediment Control) Completing Inspection / Maintenance Log / Records	MnDOT 1717 and 2573; Special Provisions: 1717 (Air, Land & Water Pollution), and 1717 (National Pollutant Discharge Elimination System (NPDES) Permit); and
Project Specific Construction Staging	The Plans; MnDOT 1717; Special Provisions: 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit); and 1806 (Determination and Extension of Contract Time)
Temporary Erosion / Sediment Control	The Plans; MnDOT 2573 and 2575
Maintenance of Devices / Sediment removal Removal or Tracked Sediment Removal of Devices	The Plans; MnDOT 1717 and 2573; Special Provisions: 1514 (Maintenance During Construction), 1717 (Air, Land & Water Pollution), and 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)
Dewatering	MnDOT 2106.3 and 2451.3C; May also require DNR Permit
Temporary work not shown in the Plans Grading areas (unfinished acres exposed to erosion)	MnDOT 1717, 2573, and 2575; Special Provisions: 1717 (Air, Land & Water Pollution), and 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)
Permanent Erosion / Sediment Control and Turf Establishment	The Plans; MnDOT 1717, 2573, and 2575; Special Provisions: 1717 (Air, Land & Water Pollution), and 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)

J. Final payment will be issued when all erosion control items have been removed and the Contractor has submitted a signed Notice of Termination to the Engineer.

3.5 TEMPORARY STABILIZATION & PROTECTION

A. If grading operations are suspended or areas are not worked in for longer than 7 days, all areas of bare soil exposed to possible erosion shall be shaped to drain with minimum potential for erosion and then be temporarily seeded using Rapid Stabilization Method 3 as described in MnDOT 2575 Table 2575-3.

B. Temporary berms, dikes, slope drains or sedimentation basins will be required where possibility for water pollution may exist and permanent erosion controls are not operative.

END OF SECTION

SECTION 32 11 23 - AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stone base course.

B. Related Sections:
   1. Section 31 22 00: Grading
   2. Section 32 12 16: Asphalt Paving
   3. Section 32 13 13: Concrete Paving

1.2 SUBMITTALS

A. Materials Source: Submit name of imported fill materials suppliers.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. The class of aggregate to be used on the project shall be in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 3138, and the most current MnDOT special provisions.

PART 3 EXECUTION

3.1 GENERAL

A. Perform work in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2211, and the most current MnDOT special provisions.

3.2 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate has been inspected, gradients and elevations are correct, and are dry.

3.3 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting as needed (also refer to Section 31 23 33: Trench Excavation and Backfilling for Utilities).

B. Do not place fill on soft, muddy, or frozen surfaces.

3.4 AGGREGATE BASE PLACEMENT

A. Level and contour surfaces to elevations and gradients indicated.

B. Maintain optimum moisture content of fill materials to attain required compaction density.

C. Compaction shall be achieved by the "Specified Density Method" as described in MnDOT 2211.3.D.2.a.
   1. The full thickness of each layer shall be compacted to not less than 100 percent of maximum density. At the time of compaction, the moisture content of the base material shall be not less than 65 percent of optimum moisture.

3.5 TOLERANCES

A. Maximum Variation From Flat Surface: 1/8 inch measured with 10 foot straight edge.

B. Maximum Variation From Thickness: 1/8 inch.

C. Maximum Variation From Elevation: 1/8 inch.

3.6 FIELD QUALITY CONTROL

A. Borrow Material
   1. A sieve analysis of the borrow material to be used shall be supplied by the Contractor prior to use for each borrow source.
   2. Three samples shall be taken for sieve analysis on the first day of production.
      a. One sample shall be tested and if passing, no other testing is necessary.
      b. If the first sample fails, the other two samples shall be tested to determine acceptance and payment reductions.
      c. If samples continue to fail, the Engineer reserves the right to stop work until suitable material and passing tests are obtained.

B. The Owner or the Engineer will at random intervals check the depth of aggregate base to ensure conformance with the Contract documents. The Contractor shall be available to verify the Owner/Engineer's measurements and determine any necessary corrective action.

END OF SECTION

SECTION 32 12 16 - ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bituminous paving.
   2. Bituminous non-wearing and wearing course.
   3. Bituminous tack coat.

B. Related Sections:
   1. Section 31 22 00: Grading
   2. Section 32 11 23: Aggregate Base Course
   3. Section 32 17 23: Pavement Markings

1.2 SUBMITTALS

A. Product Data: Submit product information and mix design.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Obtain materials from same source throughout.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 MATERIALS

A. Non-wearing Course: SPNWB330B

B. Bituminous Wearing Course: SPWEB340B

C. Bituminous Path Wearing Course: SPWEA340B

2.2 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design of each class of mix for review prior to beginning of Work.

B. Test samples in accordance with MnDOT Standard Specifications for Construction, 2020 Edition and the most current MnDOT special provisions.

PART 3 EXECUTION

3.1 GENERAL

A. Perform Work in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2360, and the most current MnDOT special provisions.

3.2 EXAMINATION

A. Verify existing conditions before starting Work.

B. Verify compacted aggregate base is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify catch basin grates and frames and manhole castings are installed in correct position and elevation.

3.3 AGGREGATE BASE

A. Aggregate base: Install in accordance with Section 32 11 23: Aggregate Base Course.

3.4 PREPARATION - TACK COAT

A. Apply tack coat in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2357, and the most current MnDOT special provisions.

B. Tack coat operations shall be conducted in a manner that offers the least inconvenience to traffic, with movement in at least one direction permitted at all times without pickup or tracking of the bituminous material.

C. The tack coat shall not be applied when the road surface or weather conditions are unsuitable as determined by the Engineer. The daily application of tack coat shall be limited to approximately the area on which construction of the subsequent bituminous course can reasonably be expected to be completed that day.

D. At the time of applying bituminous tack coat material, the surface shall be dry and clean and all necessary repairs or reconditioning work shall have been completed as provided for in the Contract and approved by the Engineer.

E. All objectionable foreign matter on the surface shall be removed and disposed of by the Contractor as the Engineer approves.

F. Preparatory to placing an abutting bituminous course, the contact surfaces of all fixed structures and the edge of the in-place mixture in all courses at transverse joints and in the wearing course at longitudinal joints shall be given a uniform coating of liquid asphalt or emulsified asphalt, applied by methods that will ensure uniform coating.

3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt binder course within 24 hours of applying tack coat.

B. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

C. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.6 ASPHALT REQUIREMENTS AND PAYMENTS

A. Delete and replace the first paragraph of MnDOT 2360.3D.1 with the following:
   1. Compact the pavement to at least the minimum required Maximum Density values in accordance with Table 2360.3-1.

B. Delete and replace Table 2360.3-2of MnDOT 2360.3D.1 with BLANK.

C. Delete and replace MnDOT 2360.3D.1.j with the following:
   1. D.1.j Companion Core Testing
   2. The Department will select at least one of the two companion cores per lot to test for verification.

D. Delete and replace MnDOT 2360.3D.1.n with BLANK.

E. Delete and replace MnDOT 2360.3D.1.p with BLANK.

3.7 TOLERANCES

A. Flatness: Maximum variation of 1/8 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/8 inch.

C. Variation from Indicated Elevation: Within 1/8 inch.

3.8 FIELD QUALITY CONTROL

A. Take samples and perform tests in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2360, and the most current MnDOT special provisions.

B. The surface smoothness of the plant mixed asphalt pavement will not be evaluated.

3.9 PROTECTION OF FINISHED WORK

A. Immediately after placement, protect pavement from mechanical injury.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete pavements.
   2. Concrete sidewalks.
   3. Concrete curbs.
   4. Colored Concrete.

B. Related Sections:
   1. Section 31 22 00: Grading
   2. Section 32 11 23: Aggregate Base Course
   3. Section 32 12 16: Asphalt Paving

1.2 SUBMITTALS

A. Product Data: Submit data on curing compounds.

B. Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of Work.

1.3 QUALITY ASSURANCE

A. Obtain cementitious materials from same source throughout the project.

B. Obtain aggregate materials from same source throughout the project.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F or surface is wet or frozen.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel shall be epoxy coated as specified in MnDOT Standard Specifications for Construction, 2020 Edition, Section 3301, and the most current MnDOT special provisions.

B. Dowel Bar shall be as specified in MnDOT Standard Specifications for Construction, 2020 Edition, Section 3302, and the most current MnDOT special provisions.

C. Reinforcing Steel Fabric shall be as specified in MnDOT Standard Specifications for Construction, 2020 Edition, Section 3303, and the most current MnDOT special provisions.

2.2 CONCRETE MATERIALS

A. Concrete Materials shall be as specified in MnDOT Standard Specifications for Construction, 2020 Edition, Section 2461, the most current MnDOT special provisions, and the “Certified Ready-Mix Plants” special provision. The concrete mix design designations for each element of work are listed below.
   1. Pavement – 3F52.
   2. Valley Gutter – 3F52.
   3. Slip-form Curb & Gutter – 3F32.

4. Hand-form Curb & Gutter – 3F52.
5. Sidewalks – 3F52.

2.3 COLORED CONCRETE

A. Concrete identified as colored on the architectural plans shall be batched into the mix at the plant, such that the entirety of the concrete section is colored and not just the surface.

B. Surface admixtures or powders are not acceptable.

C. The Architect will select two (2) standard colors from the manufacturers standard color pallet for us on the project.

D. Approved color providers are BASF, MasterColor, Prism Pigments or Architect Approved Equal.

E. To ensure accurate color mixture, the Contractor shall construct a field mockups of not less than 3 cubic yards using procedures, equipment, materials, simulated repairs, curing procedures, and quality control plan submitted for production of cast-in-place colored concrete.

2.4 SOURCE QUALITY CONTROL AND TESTS

A. Provide mix designs for concrete pavement, concrete curbs and gutters, and concrete sidewalks.

B. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify compacted aggregate base is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify catch basin grates and frames and manhole castings are installed in correct position and elevation.

3.2 SUBBASE

A. Aggregate Base Course: Install as specified in Section 32 11 23.

3.3 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

C. Notify Owner/Engineer minimum 48 hours prior to commencement of concreting operations.

3.4 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

A. Place reinforcement and dowels as indicated on details in the Plans.

3.6 PLACING CONCRETE

A. Place concrete curb and gutter in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2531, and the most current MnDOT special provisions.

B. Place concrete sidewalks in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2521, and the most current MnDOT special provisions.

C. Place concrete pavement in accordance with MnDOT Standard Specifications for Construction, 2020 Edition, Section 2301, and the most current MnDOT special provisions.

D. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

E. Place concrete continuously over the full width of the panel and between predetermined construction joints.

F. Do not break or interrupt successive pours such that cold joints occur.

3.7 JOINTS

A. Provide joints per MnDOT Standard Specifications for Construction, 2020 Edition, Section 2301, Section 2521, Section 2531, and the most current MnDOT special provisions. Align curb and sidewalk joints.

B. Provide scored or sawn joints between sidewalks and curbs and between curbs and pavement as shown on details in the Plans.

C. Provide keyed joints as indicated on details in the Plans.

3.8 FINISHING

A. Driveway Paving: Light broom, parallel to the direction of travel.

B. Sidewalk Paving: Light broom, perpendicular to the direction of travel.

C. Curbs and Gutters: Light broom, perpendicular to the direction of travel.

D. Place curing compound on exposed concrete surfaces immediately after finishing.

3.9 COLORED CONRETE

A. Colored Concrete shall be batched, installed, finished and cured in accordance with the manufacturer’s recommendations.

B. Deviations from the manufacturer’s recommendations that result in discoloration, variable colors or other visible defects shall be removed and replaced.

3.10 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 in 10 ft.

B. Maximum Variation From True Position: 1/4 inch.

3.11 FIELD QUALITY CONTROL

A. Three concrete test cylinders will be taken for every 100 or less cubic yards of each class of concrete placed each day.

B. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

C. One slump, and one air test will be taken for each set of test cylinders taken.

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

3.12 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavements, curbs and sidewalks for 5 days minimum after finishing.

END OF SECTION

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. This work shall consist of furnishing and applying paint on pavement surfaces, in the form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings, in accordance with the details as shown or as prescribed by the Owner.

1.2 SUBMITTALS

A. Furnish Manufacturer's Certificates and Data certifying that the following materials conform to the requirements specified.

PART 2 PRODUCTS

2.1 PAINT

A. Paint for marking pavement (parking lot and zone marking) shall meet MnDOT spec 3591. Owner will make color selections.

2.2 PAINT APPLICATOR

A. Apply all marking by approved mechanical equipment. The equipment shall provide constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in the case of skip lines. The equipment shall have manual control to apply continuous lines of varying length and marking widths as shown. Provide pneumatic spray guns for hand application of paint in areas where a mobile paint applicator cannot be used, use a separate piece of equipment. An experienced technician that is thoroughly familiar with equipment, materials, and marking layouts shall control all painting equipment and operations.

2.3 SANDBLASTING EQUIPMENT

A. Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall furnish not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Thoroughly clean all surfaces to be marked before application of paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals.

3.2 APPLICATION

A. Apply uniformly painted pavement marking of required color(s), length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces in conformance with the details as shown and established control points. The length and width of lines shall conform within a tolerance of plus or minus 3 inches and plus or minus 1/8 inch, respectively, in the case of skip markings. The length of intervals shall not exceed the line length tolerance. Temperature of the surface to be painted and the atmosphere shall be above 50°F and less than 95°F. Apply the paint at a wet film thickness of 0.015 inch. Apply paint in one coat. Markings showing light spots may receive additional coats. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic. If there is a deficiency in drying of the marking, discontinue paint operations until cause of the slow drying is determined and corrected. Remove and replace marking that is applied at less than minimum material rates; deviates from true alignment; exceeds stipulated length and width tolerances; or shows light spots, smears, or other deficiencies or irregularities. Use carefully controlled sand blasting, approved grinding equipment, or other approved method to remove marking so that the surface to which the marking was applied will not be damaged.

3.3 PROTECTION

A. Conduct operations in such a manner that necessary traffic can move without hindrance. Protect the newly painted markings so that, insofar as possible, the tires of passing vehicles will not pick up paint. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic. Efface and replace damaged portions of markings at no additional cost to the Owner.

3.4 DETAIL PAVEMENT MARKING

A. Use Detail Pavement Markings, exclusive of actual traffic lane marking, at exit and entrance islands and turnouts, on curbs, at crosswalks, at parking bays, and at such other locations as shown. Show the International Handicapped Symbol at indicated parking spaces. Color shall be selected by owner. Apply paint for the symbol using a suitable template that will provide a pavement marking with true, sharp edges and ends. Place detail pavement markings of the color(s), width(s) and length(s), and design pattern at the locations shown.

3.5 FINAL CLEAN-UP

A. Remove all debris, rubbish and excess material from the Station.

END OF SECTION

SECTION 32 58 00 - LANDSCAPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Final Grading
   2. Fertilizer
   3. Seed
   4. Hydro-mulch

1.2 SUBMITTALS

A. Furnish the Engineer with the Supplier's or Manufacturer's product specification data or testing results stating the materials furnished meet the requirements of the specifications.

B. Furnish the Engineer with a certificate of compliance stating the species, sizes, quantities furnished, and nursery supplier.

PART 2 PRODUCTS

2.1 FERTILIZER

A. Fertilizers shall be applied at a rate determined by the seed or sod supplier. The type of fertilizer shall be determined based on the type and properties of the topsoil, seed or sod.

B. The Contractor shall apply the fertilizers until the turf has been established, i.e. until all seeded areas have developed into turf or all new sod areas have developed a sound root structure.

C. Once the turf has been established and accepted by the Engineer and Owner, the Owner will be responsible for further fertilizing of the landscaped areas.

2.2 SEED

A. Furnish materials in accordance with MnDOT Standard Specifications for Construction, Latest Edition, Section 3876, and the most current MnDOT special provisions except as modified herein.

B. All seed shall conform to the latest seed law of the State, including those governing labeling and weed seed tolerances. Tolerances for Germination and Purity, as determined by the Department of Agriculture, shall only apply to seed that has been previously tested and approved by the Department of Agriculture as a seed lot.

C. All native grass, sedge, rushes and forbs seed shall be either origin certified or wild-type. Origin Certified Seed, designated as MCIA yellow tag species shall be used in all native seed mixes. Wild type may be substituted for yellow tag species only by obtaining approval of the Engineer and the Erosion Control Engineering Unit from the Office of Environmental Services. Origin shall be clearly identified on the seed label for all seed, including native forbs.

2.3 MULCH & HYDRAULIC SOIL STABILIZER

A. Furnish materials in accordance with MnDOT Standard Specifications for Construction, Latest Edition, Section 3882, Section 3884, and the most current MnDOT special provisions.

2.4 FERTILIZER

A. Furnish materials in accordance with MnDOT Standard Specifications for Construction, Latest Edition, Section 3881, and the most current MnDOT special provisions.

2.5 ROLLED EROSION PREVENTION PRODUCTS

A. Furnish materials in accordance with MnDOT Standard Specifications for Construction, Latest Edition, Section 3885, and the most current MnDOT special provisions.

2.6 WATER

A. Water shall be clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

PART 3 EXECUTION

3.1 GENERAL

A. Perform Work in accordance with MnDOT Standard Specifications for Construction, Latest Edition, Section 2575, and the most current MnDOT special provisions.

B. The Contractor shall be responsible for temporary seeding and all costs associate with temporary seeding to comply with NPDES permit requirements and MnDOT seeding dates identified in MnDOT Standard Specifications for Construction, Latest Edition, Section 2575, and the most current MnDOT special provisions.

3.2 FINISH GRADING

A. Verify subgrade and trench backfilling have been inspected.

B. Verify subgrade has been contoured and compacted.

C. Where topsoil is to be placed, scarify surface to depth of 4 inches

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 6 inches.

E. Place topsoil in areas where seeding, sod, and planting are indicated.

F. Place topsoil to a minimum of 4” compacted thickness.

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading and prior to seeding or sod placement.

I. Near plants spread topsoil manually to prevent damage.

J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

K. Lightly compact placed topsoil.

3.3 SOIL PREPARATION

A. Soil preparation shall be per MnDOT Standard Specifications for Construction, Latest Edition, Section 2574, and the most current MnDOT special provisions.

B. Immediately prior to placing the topsoil, scarify the existing soils to a minimum depth of 6 inches for all areas on slopes shallower than 2 horizontal to 1 vertical.

C. Perform soil preparation immediately prior to seeding or placing sod to prevent undesirable weed growth or soil erosion.

D. Place the topsoil and spread uniformly over lawn areas to a minimum depth of 4 inches, unless a specific depth is stated elsewhere. Firm and smooth the topsoil after working the soil.

E. Apply a starter fertilizer at the Manufacturer's or Supplier's recommended rates and work into the topsoil. The lag time between seeding or placing sod and fertilizing shall not exceed 48 hours.

F. Rake the surface until it is smooth and of uniform fine texture immediately prior to seeding or placing sod.

3.4 SEEDING

A. The seed mixture shall be placed with a seed drill that will accurately meter the types of seed to be planted and keep all seeds uniformly mixed during drilling. The application rate for seed mixes 25-151 shall be 200 lbs/acre. The drill shall be equipped with disk furrow openers and packer assembly to compact the soil directly over the drill row. Seeding shall be done at a right angle to the surface drainage. The seeding shall be done with two passes over the entire area, with the second pass in a direction at a right angle to the first pass.

B. Seeded areas shall have the seedbed firmed after seeding and prior to mulching. Soil firming shall be done with a drag cultipacker or other approved soil firming equipment. On slopes too steep to operate mechanical equipment, the seed shall be covered by hand raking or other approved means, wherever feasible, prior to mulching. Accomplish the soil firming or seed covering immediately after seeding.

C. The mulch shall be spread by mechanical means to provide a uniform distribution at an application rate of 2.0 tons/acre of MnDOT Type 3 Mulch.

D. Seed placed under the Contract shall be fertilized and watered and maintained by the Contractor until it has reached 70% density of its expected final growth.

3.5 HYDROSEEDING

A. Mix the seed, fertilizer, and mulch material in the required amount of water to produce a slurry mixture.

B. Mulching shall be executed in accordance with MnDOT Standard Specifications for Construction, Latest Edition, Section 2575, and the most current MnDOT special provisions.

C. Mulch shall be Type 4 in areas seeded with MnDOT seed mixture 25-151 and applied at a rate of 1.5 tons per acre immediately following seeding and shall be immediately over-sprayed with Stabilized Fiber Matrix at 750 lbs/acre.

D. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

E. Incorporate the mulch into the slurry mix after the seed and fertilizer have been thoroughly mixed.

F. Direct the spray during the application to obtain a uniform material distribution.

G. Empty the slurry mixture within one hour after the seed is added to the tank.

H. Hydroseed placed under the Contract shall be fertilized and watered and maintained by the Contractor until it has reached 70% density of its expected final growth.

3.6 ROLLED EROSION PREVENTION PRODUCTS

A. Rolled erosion prevention products shall be executed in accordance with MnDOT Standard Specifications for Construction, Latest Edition, Section 2575, and the most current MnDOT special provisions.

B. Temporary rolled erosion prevention products shall be Category 20 unless otherwise shown on the Plans and shall be used with the seed mixtures designated on the Plans.

3.7 MAINTENANCE

A. Water to prevent grass and soil from drying out.

B. Roll surface to remove minor depressions or irregularities.

C. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

D. Immediately reseed areas showing bare spots.

E. Repair washouts or gullies.

3.8 PROTECTION AND CLEANING

A. Keep the pavements clean and the work area in an orderly condition during landscaping work.

B. Protect the landscape work and materials from damage due to landscape operations or by other Contractors and trades, and trespassers. Maintain the protection measures during the installation and maintenance periods.

END OF SECTION

SECTION 33 14 00 - WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Watermain pipe.
   2. Water service pipe.
   3. Gate Valves.
   4. Hydrants.
   5. Ductile Iron Fittings.
   6. Thrust Blocking.
   7. Tracer Wire & Test Stations.

B. Related Sections:
   1. Section 31 23 33 – Trench Excavation and Backfilling

1.2 SUBMITTALS

A. Submit product data on pipe materials, pipe fittings and accessories.

B. Submit Manufacturer's Certificate certifying products meet or exceed specified requirements.

C. Submit record drawings.

1.3 CLOSEOUT SUBMITTALS

A. For Project Record Documents: Record actual locations and ties of piping mains, fittings, corporation stops, curb stops, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store pipes in shipping containers with labeling in place until ready for use.

PART 2 PRODUCTS

2.1 WATER PIPE

A. All Water pipe and fittings shall be manufactured and constructed in accordance with the State Plumbing Code and any local jurisdiction requirements.

2.2 PVC WATER PIPE

A. PVC watermain pipe shall be manufactured in accordance with the requirements of AWWA C900 for 4” through 12” diameter pipe.

B. PVC watermain pipe shall be PVC Class 150, DR18 for all pipes up to and including 12” diameter.

C. PVC water main pipe shall be resistant to aggressive soils or corrosive substances in accordance with the requirements of ASTM D-543.

2.3 FITTINGS

A. All fittings shall be manufactured and constructed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. Fittings shall have an asphaltic coating at least one mil thick on all exterior surfaces. Spotty of thin seal coating, or poor coating adhesion, shall be cause for rejection.

C. Restrainer glands shall be Megalug of approved equal.

D. Stainless steel or Cor-Blue bolts shall be used for all fitting connections.

2.4 GATE VALVES

A. Gate valves shall meet the requirements of AWWA C509-80 and shall be single disc type with resilient seat bonded. With a water working pressure of not less than 150 psi.

B. Gate valves shall be provided with a two-inch square operating nut, painted white, opening counterclockwise.

C. Gate valves shall include a stationary valve rod extension which attaches to the operating nut and extends to within 1’ of the valve box cover.

D. Valve boxes shall be three piece, 5 ¼”, screw type for a burial depth of 8’ or as shown on the plans and shall be Mueller, Tyler, Bibby or Engineer approved equal.

E. Valve boxes shall be of sufficient length to provide for minimum adjustment of 6” above and below grades when the pipe is installed to specified depth.

2.5 HYDRANTS

A. Hydrants shall conform to the applicable requirements of AWWA C502.

B. Hydrants shall be Waterous WB-67, American B-62-B with breakaway flange or Engineer approved equal.

C. Hydrant bury depth, measured from the top of the branch pipe connection to the finished ground line at the hydrant, shall be 8’.

D. Hydrants shall have 16” from the breakaway flange to the discharge fittings.

E. Hose and streamer connection shall match sizes and type of thread with City fire department (Two hose nozzles, one pumper nozzle). Coordinate size and thread with local fire department.

F. Hydrants shall be provided with outlets for drainage in the base or barrel, or between the base and barrel.

G. Hydrant operating nut shall be rotated counterclockwise to open.

H. Restrainer glands shall be Megalug of approved equal.

I. Hydrants shall be repainted prior to acceptance, if paint has been damaged.

J. Hydrant markers shall be RoDon 5’ Hydra-finder attached using the RoDon flat mounting bracket, Hy-Viz 5’ Traditional fiberglass Hydrant Marker with bolt mount, or Engineer approved equal.

2.6 TRACER WIRE

A. Tracer wire shall be #12 AWG copper-clad steel wire with 30 mils of blue HDPE coating.

B. Tracer wire shall be spliced using a direct bury splice kit and be covered with a flame retardant compound.

C. Tracer wire test stations shall be Rhino TriView Flex Test Station, Carsonite Perma-Post Test Station or Engineer approved equal.

D. Tracer wire test stations shall be 72” tall, blue in color, with two internal terminals and water pipeline stickers affixed to them.

2.7 CORPORATION STOPS

A. Corporation stops shall meet the requirements of AWWA C800.

B. Corporation stops shall be ball type and manufactured by Ford, AY McDonald, Mueller or Engineer approved equal.

C. Stainless steel strap saddles shall be included with each corporation stop.

2.8 CURB STOPS & BOXES

A. Curb stops & boxes shall meet the requirements of AWWA C800.

B. Curb stops shall be ball type, Minneapolis pattern valve and manufactured by Ford, AY McDonald, Mueller or Engineer approved equal.

C. The fittings on the corporation stop and curb stop shall be compression type.

D. Curb boxes shall have a stationary rod; lid with brass pentagon head plug; the ability to extend up to 96”; Minneapolis pattern base to attach to curb stop; and be manufactured by Ford, AY McDonald, Mueller or Engineer approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. All Water pipe and fittings shall be installed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. When replacing existing watermain and services, the existing water supply must remain active during construction. The Contractor shall make the necessary arrangements to provide uninterrupted water service to all properties adjacent to the project.

3.2 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify utility main size, location, and invert are as indicated on Drawings.

3.3 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.4 EXCAVATION, TRENCHING & BEDDING

A. Excavate pipe trench in accordance with Section 31 23 33 for the work of this section.

B. Granular bedding material and encasements are required as indicated in the plans.

C. In wet or unsuitable soil conditions, the Contractor shall excavate 6” below the bottom of the pipe, furnish and install a 6” crushed rock foundation to provide support for the pipe installation. The rock will be incidental to pipe cost.

3.5 WATER PIPING

A. All Water pipe shall be installed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. Maintain separation of water main from sanitary sewer and storm sewer of 10 feet in accordance with Minnesota Department of Health and Minnesota Department of Labor & Industry requirements.

C. When crossing sanitary sewer mains or services, a minimum of 18” of vertical separation shall be provided and one full length of water pipe shall be centered at the point of crossing so both joints will be equidistant and as far from the sewer as possible.

D. Have sufficient materials available to allow for unknown conditions that may be encountered.

E. Have sufficient tools on-site that may be necessary during construction of the watermain; such as, valve box wrenches, curb stop wrenches, gate valve keys, etc.

F. Install pipe to indicated elevation to within tolerance of a 1/2 inch.

G. Establish elevations of buried piping with not less than 8ft of cover.

H. When using a bar to push the watermain pipe home, wood blocking shall be used to protect the bell or spigot of the pipe from being damaged.

I. Install concrete for thrust restraints at each elbow or change of direction of pipe main and as shown in the plans.

J. Support blocking, reaction blocking and anchorage devices shall be provided as detailed in the plans.

K. Excavations shall not be backfilled until fittings and connections have been inspected by the Owner or the Engineer.

L. Excavations shall not be backfilled until necessary information for record drawings has been recorded.

M. Curb stops & boxes shall be adjusted to within 1” of finished grade.

N. Curb boxes in driveways shall have a short top section of a valve box installed to protect the curb stop and curb box as shown in the plans.

3.6 FITTINGS

A. All Water fittings shall be installed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. All plugs, caps, tees, bends and other thrust points shall be provided with reaction backing, or movement shall be prevented by attachment of suitable restraining devices, megalugs or tie rods in accordance with plans.

C. Fittings shall be protected with an 8-mil polyethylene encasement in accordance with ANSI/AWWA C105/A21.5-88.

3.7 GATE VALVES

A. Support blocking, reaction blocking and anchorage devices shall be provided as detailed in the plans.

B. Center and plumb valve box over valve. Set box ½" below finished grade in pavements or sidewalk, flush with finished grade in turf areas, and 3" below finished grade in aggregate roads and alleys.

C. Gate valves shall be protected with an 8-mil polyethylene encasement in accordance with ANSI/AWWA C105/A21.5-88.

3.8 HYDRANTS

A. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway. Turning hydrant heads shall be incidental to the cost of the hydrant.

B. Support blocking, reaction blocking and anchorage devices shall be provided as detailed in the plans.

C. Set hydrants to grade, with nozzles at least 24 inches above ground.

D. Hydrant bury depth, measured from the top of the branch pipe connection to the finished ground line at the hydrant, shall be 8'.

E. Provide drainage pit as shown in the plans.

F. Do not connect drain opening to sewer.

G. Plug drain holes if hydrant is located in water table or in areas with contaminated soils and equip with notification that hydrant needs to be pumped after use.

3.9 TRACER WIRE

A. Tracer wire shall be attached to the top and in the center of the pipe as necessary such that the wire is not displaced during backfilling operations.

B. Tracer wire shall be brought to the surface as shown in the plans at the end of the main, at each valve box, at each hydrant, and shall be connected to existing tracer wire when connecting to an existing main.

C. Sufficient tracer wire shall be left around curb stop to allow for extension of the tracer wire to the residence with the extension of the water service.

D. Tracer wire test stations shall be connected to the tracer wire and installed at every hydrant.

3.10 FIELD QUALITY CONTROL

A. Before being placed into service, all Water pipe shall be tested in accordance with the State Plumbing Code and any local jurisdiction requirements including bacteria testing.

B. Electric Conductivity Test:

1. All tracer wire shall be tested for electrical conductivity from tracer wire test station to tracer wire test station.

C. Any portion of the work deemed to be defective through the testing shall be remedied at no additional cost to the Owner.

D. Jurisdictional Authority, Owner, or Engineer shall be present for all testing for verification of results.

E. The Owner will not consider final acceptance or substantial completion until all testing and corrective action is completed to the satisfaction of the Jurisdictional Authority or Engineer.

3.11 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 31 00 - SANITARY SEWERAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sanitary sewer service pipe.
   2. Sanitary sewer forcemain pipe.

B. Related Sections:
   1. Section 31 23 33: Trench Excavation and Backfilling for Utilities
   2. Section 33 32 11: Wastewater Pumping Stations

1.2 SUBMITTALS

A. Submit data on pipe materials, pipe fittings and accessories.

B. Submit shop drawings of the sanitary sewer manholes to the Engineer for review prior to fabrication.

C. Certify Products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents:
   1. Record actual locations and ties of piping mains, manholes, wyes, service cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store pipes in shipping containers with labeling in place until ready for use.

B. Deliver and store manhole within project site. Where applicable, manholes shall be stored on the backslopes of any ditches.

PART 2 PRODUCTS

2.1 COMPOSITE UTILITY ID POST

A. Composite utility ID posts installed by manholes outside of roadways or alleys shall be manufactured by Carsonite, Rhino, or Engineer approved equal.

B. Utility ID posts shall be Sewer Green in the uniform APWA color coding scheme or approved equal.

2.2 PRECAST JOINT EXTERNAL SEAL WRAP

A. Precast joint external seal wrap shall be an 8” single continuous rubber band made of EPDM rubber with a minimum thickness of 65 mils.

B. The seal shall be secured by a 2” wide mastic strip on the top and bottom edge of the rubber wrap.

C. The mastic shall be non-hardening butyl rubber sealant and shall adhere to two different manhole sections.

2.3 EXTERNAL RUBBER SEALING SLEEVE

A. External chimney seals shall be a single continuous rubber band made of EPDM rubber with a minimum thickness of 65 mils.

B. The seal shall be secured by a 2" x ¼" mastic strip on the top and bottom edge.

C. The mastic shall be non-hardening butyl rubber sealant and shall seal the cone/top slab of the manhole and over the lip of the casting.

2.4 SANITARY SEWER SERVICES

A. All PVC pipe and fittings shall be manufactured and constructed in accordance with the State Plumbing Code and any local jurisdiction requirements.

2.5 SANITARY SEWER FORCEMAIN PIPE

A. All PVC forcemain pipe and fittings shall be manufactured and constructed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. PVC forcemain pipe shall be certified to NSF International Standard No. 61.

C. All fittings shall be cast iron or ductile iron, shall conform to AWWA C110 or C153, and shall be tar coated inside and outside.

D. Stainless steel bolts shall be used for all mechanical joints or flanged fittings.

2.6 TRACER WIRE

A. Tracer wire shall be #12 AWG copper-clad steel wire with 30 mils of green HDPE coating.

B. Tracer wire shall be spliced using a direct bury splice kit and be covered with a flame retardant compound.

C. Tracer wire test stations shall be Rhino TriView Flex Test Station, Carsonite Perma-Post Test Station or Engineer approved equal.

D. Tracer wire test stations shall be 72" tall, green in color, with two internal terminals and sewer pipeline stickers affixed to them.

PART 3 EXECUTION

3.1 GENERAL

A. All PVC pipe and fittings shall be installed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. Existing lines and wastewater flow must remain active during construction. The Contractor shall make the necessary arrangements to provide uninterrupted sanitary sewer service to all properties adjacent to the project.

3.2 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify municipal utility sewer size, location, and invert are as indicated on Drawings.

3.3 EXCAVATION, TRENCHING & BEDDING

A. Excavate for manhole and pipe trench in accordance with Section 31 23 33: Trench Excavation and Backfilling for Utilities for the work of this section.

B. Granular bedding material and encasements are required as indicated in the plans.

C. In wet or unsuitable soil conditions, the Contractor shall excavate 6” below the bottom of the pipe, furnish and install a 6” crushed rock foundation to provide support for the pipe installation. Foundation rock will be incidental to pipe installation price.

3.4 SANITARY SEWER SERVICES

A. All PVC pipe and fittings shall be installed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. All service fittings, including wyes, bend, and cleanouts, shall have 1 ½” crushed or natural rock as foundation material.

C. Cleanouts shall be extended to within 6 inches of finished grade elevation.

D. When using a bar to push the sanitary sewer pipe home, wood blocking shall be used to protect the bell or spigot of the pipe from being damaged.

E. Excavations shall not be backfilled until connections have been inspected by the Jurisdictional Authority, Owner or Engineer.

F. Excavations shall not be backfilled until necessary information for record drawings has been recorded.

3.5 FORCEMAIN

A. All PVC forcemain pipe and fittings shall be installed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. Maintain separation of water main from sanitary sewer and storm sewer of 10 feet in accordance with Minnesota Department of Health requirements.

C. Have sufficient materials available to allow for unknown conditions that may be encountered.

D. When using a bar to push the sanitary sewer pipe home, wood blocking shall be used to protect the bell or spigot of the pipe from being damaged.

E. Install pipe to indicated elevation to within tolerance of ½”.

F. When bends are installed on the forcemain, they shall be blocked in accordance with the plans or may be restrained with retainer clamps and rods.

G. Any fittings, blocking, retainer clamps or rods required to install the forcemain as shown in the plans shall be included with the unit price bid for forcemain installation.

3.6 TRACER WIRE

A. Tracer wire shall be attached to the top and in the center of the pipe as necessary such that the wire is not displaced during backfilling operations.

B. Tracer wire test stations shall be installed at every air release manhole and at every lift station. Locations to be determined in the field by the Contractor, the Owner and the Engineer’s on-site representative.

3.7 FIELD QUALITY CONTROL

A. All PVC pipe and fittings shall be tested in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. Upon completion of testing, all sanitary sewer pipe 8 inches in diameter or larger shall be jetted and televised prior to final acceptance and system startup.

C. Upon completion of jetting the sanitary sewer main, all sanitary sewer manholes shall be cleaned prior to final acceptance and system startup.

D. All tracer wire shall be tested for electrical conductivity from tracer wire test station to tracer wire test station.

E. Any portion of the work deemed to be defective through the testing shall be remedied at no additional cost to the Owner.

F. Jurisdictional Authority, Owner, or Engineer shall be present for all testing for verification of results.

G. The Owner will not consider final acceptance or substantial completion until all testing, jetting, and corrective action is completed to the satisfaction of the Engineer.

3.8 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 32 11 - WASTEWATER PUMPING STATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wastewater Pumping Stations.

B. Related Sections:
   1. Section 31 23 33: Trench Excavation and Backfilling for Utilities
   2. Section 33 31 00: Sanitary Sewerage Piping
   3. Section 33 32 12: Wastewater Air Release Manholes

1.2 SUBMITTALS

A. Section 01 33 00: Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Submit shop drawings of the lift station wet well to the Engineer for review prior to fabrication.
   2. Submit pipe layout for lift station wet well based on equipment selected to the Engineer for review prior to construction.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Submersible Centrifugal Pump
   1. The Manufacturer shall submit 5 copies of the following:
      a. Certified results of factory tests, including a certified pump performance curve.
      b. Pump outline drawings.
      c. Typical installation guides.
      d. Technical manuals.
   2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Section 00 17 00: Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of manholes.

C. Start-up Authorization Form: As described in 1.5 below.

D. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 00 16 00: Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver and store lift station wet well and valve manhole within project limits.

C. Deliver and store pumps in shipping containers with labeling in place until ready for use.

1.5 QUALITY ASSURANCE

A. Upon completion of the start-up and testing, the manufacturer shall submit to the Engineer the start-up authorization form describing the results of the tests performed for each lift station including the drawdown testing.

B. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed.

C. Submersible Centrifugal Pumps
   1. All pumps shall be furnished by a single Manufacturer throughout the Work.
   2. The Contractor shall follow pump Manufacturer's installation instructions.
   3. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed.
   4. The pump manufacturer shall perform the following inspections and tests on each pump prior to shipment from the factory:
      a. Impeller, motor rating and electrical connections shall first be checked for compliance to the customer's purchase order.
      b. A motor and cable insulation test for moisture content or insulation defects shall be made.
      c. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
      d. The pump shall be run for 30 minutes submerged a minimum of six (6) feet under water.
      e. After operation test (D), the insulation test (B) is to be performed again.
      f. Hydraulic performance tests are required. Tests shall be conducted in accordance with the Standards of the Hydraulic Institute. The pumps must develop the specified capacity.
      g. Certified results of the above testing shall be furnished to the Engineer.

1.6 MAINTENANCE MATERIALS

A. For each set of pumps, the Contractor shall provide 2 spare impellers and 2 spare wear rings.

1.7 PUMP WARRANTY

A. The manufacturer of the equipment shall warrant the <u>total package</u> for one year from date of acceptance. The major wear parts such as mechanical seal, impeller, pump housing, wear ring and ball bearings are pro-rated over a full 5 years.

B. The pump manufacturer shall warrant the units being supplied to the owner against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in printed form and apply to all similar units. The warranty shall be in Owner's name.

<u>PART 2 PRODUCTS</u>

2.1 COMPLETE GRINDER PACKAGE

A. Grinder Station shall be a Pentair Hydromatic TL-Pro System Complete Grainder System including the following:
   1. Fiberglass or HDPE Wet Well Structure
   2. Access Cover with Hatch & Fall Protection

3. EZ-Out Rail System
4. Cast Iron Discharge Elbow
5. Check Valve
6. Gate Valve
7. Anti-Siphon Valve
8. Duplex Pumps as identified below.
9. Control Panel as identified below.

2.2 PIPE, FITTINGS & ACCESSORIES

A. All Pipe, Fittings & Accessories inside the wet well in contact with sewage or gases shall be stainless steel as shown on the plans.

B. All other accessories shall be aluminum, stainless steel, PVC coated or equal.

2.3 VENT

A. Grinder station shall be vented in accordance DOLI requirements.

2.4 SUBMERSIBLE SOLIDS HANDLING PUMPS

A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide submersible solids handling pumps as specified herein as supplied by W.W. Goetsch Associates.

B. Furnish and install, two (2) Hydromatic HPGH series or premium grinder submersible sewage pumps as specified herein.
   1. Pumps shall be equipped with stainless steel nameplate, stating the unit is accepted for use in Standard Location or NEC class 1, division 1, groups C, D hazardous location with third party, Factory Mutual, approval.
   2. Pumps shall be non-overloading throughout the entire range of operation without employing service factor. Pump shall reserve a minimum service factor of 1.30. The performance curve submitted for approval shall state in addition to head and capacity performance, the pump efficiency, solid handling capacity and reflect motor service factor.
   3. The pumps shall be Hydromatic HPGH (3450 RPM)
      a. Impeller: Grinder
      b. Discharge: 2” ANSI flange
      c. Power Cord: Epoxy potted and equipped with a minimum of 50’ of power cord
      d. Motor shall be of oil filled design and be Explosion Proof listed with the following characteristics:
         1) 3 HP
         2) 460V
         3) 60 Hz
         4) 3 Phase
      e. Pump Operating Characteristics:
         1) Capacity (GPM): 50
         2) Head (TDH in FT.): 35
   4. Castings for cord cap, motor housing, bearing housing and seal plate shall be ASTM A48 Class 30 Cast Iron.
   5. Pump shaft shall be 416 Stainless Steel

6. Impeller meet the requirements of ASTM A48 Cast Iron Class 30 or ASTM A536 Ductile Iron Class 65.
7. O-rings, mechanical seals and cord grommets shall be nitrile.
8. Mechanical seals shall be Carbon/Silicon Carbide.
9. Power Cord shall be Type STW/STW-A Water Resistant 600 V, 60¾ CCSA and UL Approved
10. Lifting bail shall be welded or forged 300 Series Stainless Steel

2.5 DUPLEX CONTROL PANEL

A. General:
1. Control panel shall be a Primex/SJE-Rhombus 331-SV three phase duplex lift station control panel with stationview controller or Engineer approved equal.
2. Contractor shall furnish all labor, materials, equipment and incidentals required to provide duplex motor control panel as specified herein as supplied by W.W. Goetsch Associates, Contact Bryan Goehring (612) 845-9243.
3. The motor control panel shall be assembled and tested by SJE/Rhombus meeting the Standards for U.L 508A / UL 698A for industrial controls/intrinsically safe circuit extensions and be UL labeled and serialized accordingly. The motor control panel shall be assembled and tested by the same manufacturer so as to insure suitability and assurance of experience in matching controls to motors and to insure single source responsibility for the equipment.
4. The panel shall contain all components required by the pump manufacturer for starting and protecting the motor as well as features required by the pump manufacturer for warranty of the pumps. Items such as motor thermal over-temperature detection or seal failure detection shall be included when required.
5. In coming power shall be 3 phase, 60 cycle, 460 volts.

B. Enclosure:
1. The described equipment shall be housed in a NEMA 4X, 304 Stainless Steel enclosure painted white to reduce solar absorption. The enclosure door shall be provided with a padlock-able latch and aluminum dead front operator's inner door.
2. This weatherproof, rain-tight enclosure shall be designed specifically for mounting in an unprotected outdoor location. It shall have a gasketed, hinged, front weather door with locking capability, and an internally mounted hinged dead front panel so that all the components normally actuated by Operating Personnel are accessible without opening the dead front and yet are not exposed to the elements or to unauthorized personnel.
3. The enclosure shall be mounted near the grinder station on a post.

C. Incoming Service and Surge Protective Devices:
1. The lift station control panel shall be service entrance rated. Conduit and wiring between the building and the lift station shall be furnished and installed. The power supply will be as shown on plan drawings.
2. A surge protective device shall be supplied in the control system and connected to each line of the load side of main power disconnect. The device shall protect the control system against damage as the result of transient voltage surges caused by lightning interference, switching loads and power line interference's. It shall begin shunting to ground at 1000 volts maximum.
3. Each panel shall be supplied with a properly sized control power circuit breaker. The breaker shall supply power to all control wiring within the enclosure.

D. Incoming Power Circuit Interrupts:

1. The control panel shall include a thermal magnetic main circuit breaker to provide an incoming power disconnect means and over-current protection for the control panel equipment.
2. The circuit breaker must have a minimum symmetrical RMS ampere interrupting capacity of 25,000 @ 240 volt and 18,000 @ 480 volt. The circuit breaker shall be operable through the operator's door of the enclosure and shall have a trip rating to allow full voltage starting and continuous operation of the motors.
3. The commercial power input to the control panel/main breaker shall be UL service entrance rated and labeled.
4. The control panel shall include a second circuit breaker mechanically interlocked with the main breaker to function as a emergency power interrupt and manual transfer switch. The breakers shall allow the control panel to be powered by either commercial power or the owner's portable emergency power generator. The interlock shall be padlock-able with both breakers in the "off" position. The breakers shall be operable from the control panel operator's door.
5. The control panel shall include a control power transformer for converting the high voltage incoming service to 120 VAC single phase power. The 120 VAC power shall be used to power internal control components and the 15 amp rated GFI duplex receptacle. The control power transformer shall be rated for 230/460-120 VAC single phase at 2 KVA with Class 105 Deg. C insulation and shall be UL Listed. The control power transformer shall be supplied with primary and secondary fusing.
6. The control power transformer shall be of single epoxy resin impregnated construction to eliminate the possibility of moisture, dust, dirt, and industrial contaminants from affecting operation and shortening transformer life. The unit shall have integrally molded barriers between terminals and transformer.

E. Branch Circuit Breakers and Motor Starters:
1. A thermal magnetic circuit breaker shall be supplied as branch circuit protection for each pump motor. The circuit breaker must have the same minimum ampere short circuit rating as the main breaker. The circuit breakers shall be operable through the operator's door of the enclosure and shall have a trip rating to allow full voltage starting and continuous operation of the motors. Units shall be lockable in the off position with a padlock.
2. A NEMA rated, full-voltage, across-the-line magnetic motor starter with ambient-compensated, quick-trip class 10 overload sensing for submersible pump in each phase to provide over current and running protection shall be provided for each pump motor. The overload trip setting shall be operator adjustable within normal pump operating ranges. Operator's door mounted overload reset push-buttons shall be provided.
3. A control power circuit breaker shall be provided and operable through the operators door of the control panel to provide a disconnect means and short circuit protection for any 120 VAC (or less) devices not powered from motor starter circuits.
4. Pump stations having 240 volt single phase service and motors with 5 HP or more shall be provided with VFDs for phase conversion supplying 3 phase power to the motor from 1 phase incoming service. Each motor shall be supplied with its own VFD. VFDs shall be used only in start and stop mode with the motor running at full speed for this application.
5. Panels shall be provided with thermostatically controlled forced air ventilation to prevent panel overheating.

F. Pump Control Selector Switches and "RUN" Lights:

1. The control panel shall have three position selector switches mounted on the front door for Hand-Off-Auto operation of each pump. In the Hand position the motor shall be called to operate. In the Off mode the motor shall not be allowed to operate. In the Auto mode, the motor shall operate in response to control signals from the controller.

G. Primary Controller:
   1. Pump Controller shall be Station View as manufactured by PRIMEX/SJE-RHOMBUS CONTROLS.
   2. The control panel shall include a pump controller and telemetry unit for monitoring and automatically controlling the lift station pumps in a pump down mode of operation in response to a Level process variable as based on preconfigured setpoints. Unit shall be capable of communicating station status and alarms via cellular telemetry with internet based HMI and alarm/status reporting system.
   3. The controller/telemetry system shall be a standard, catalogued product of a water and wastewater pumping automation equipment manufacturer regularly engaged in the design and manufacture of such equipment for the last 5 years. The system shall be specifically designed for water and wastewater pumping automation utilizing built-in preconfigured control and telemetry strategies allowing pump up or down mode pump control of 1 to 3 pumps.

H. Station Telemetry:
   1. The control panel shall be supplied with a Cellular based alarm and monitoring system with hosted, internet based HMI website. As a minimum the system shall have the following features and functions:
   2. The telemetry system shall be integrated with the controller to permit full access to the controller status and alarms, historical data, control and alarm setpoints and allow for remote operator override control of the pump station.
   3. The cellular connection capability shall allow any authorized user to securely connect to the system from anywhere with an Internet connection. The system shall be accessed utilizing a standard web browser software package, which shall function as a traditional SCADA system software interface.
   4. The system shall provide immediate notification of facility operational and security alarms utilizing the following Owner furnished communication methods:
      a. E-mail account notification.
      b. Standard Owner pager systems.
      c. Designated phone call.
      d. Text Messages
      e. All four methods at once.
   5. The system shall include 2 year service plan that will provide system updates for the following occurrences:
      a. Alarm Activation
      b. Alarm Clear
      c. Status Change (Pump On/Off, etc…)
      d. Wet well level change of 10% or more.
      e. Station flow rate change of 10% or more.
   6. Station telemetry shall be Pump Watch as manufactured by PRIMEX/SJE-RHOMBUS CONTROLS.

I. Submersible Level Transducer:

1. The liquid level of the wetwell shall be sensed by maintenance free Loop Powered Submersible Level Transducer system that uses reliable hydrostatic head pressure sensing principle to provide an accurate and reliable proportional 4-20 mA signal representing level/pressure. Other technologies that can be affected by foaming, turbulence, grease, suspended solids build up, atmospheric changes, condensation, or false echoing shall not be acceptable. Submersible sensor systems that use protective caps or cages to protect the sensing diaphragm, are susceptible to solids build up, shall be considered high maintenance and unreliable, and shall not be acceptable.
    a. The transducer shall be suitable for continuous submergence and operation and shall be installed in accordance with manufacturer's instructions. The bottom diaphragm face of the sensor shall be installed 6 inches above the floor at elevation. The sensor shall be mounted using a stainless steel cable system in a location and as shown on the job plans.
    b. The sensor shall be suspension-mounted using a cable suspension mounting kit, consisting of a 2' long 1-inch NPT type 316 stainless steel pipe with coupling, bolt, cable clamps and hardware along with the required length of 1/8 inch diameter.
    c. Provide an intrinsically safe barrier between the control panel and lower assemblies The barrier shall render the level sensing system suitable for use in Class 1, Division 1 Groups A, B, C and D, Class 2, Division 1, Groups E, F and G, and Class 3, Division 1 hazardous locations.

J. Local Alarm System:
1. A weatherproof, strobe alarm indication light assembly with shatter resistant polycarbonate red lens mounted on a polycarbonate/ABS blend case shall be provided. The alarm light shall be NEMA 4X rated, suitable for indoor or outdoor mounting and operate on 12 VDC and be PLC rated. The strobe tube shall provide a minimum of 300,000 peak candela output and shall be rated for 3,000 hour life.
2. The alarm light shall flash upon occurrence of an alarm condition.
3. A audible alarm horn assembly with silence push-button, shall be provided. The alarm horn suitable for indoor or outdoor mounting and operate on 12 VDC. The horn shall provide a minimum of 78dB output and shall be rated for at least 400 hour life @ 50% duty cycle. The push-button shall be 30.5mm, NEMA 4X rated.

K. Redundant Liquid Level Responsive High Level Alarm/Pump Control:
1. An independent high level alarm and redundant pump control capability with features as hereinafter listed shall be provided in addition to the specified primary control system.
2. A Pump Controller shall be furnished to automatically provide wet well level alarm monitoring and control of pumps based on float switch inputs. The controller shall be flexible for future considerations and come preconfigured with multiple modes of control for up to 2 pumps in either a pump up or pump down mode of operation as based on up float switch inputs. Operation mode shall be easily adjusted by the operator via built in rotary switch. No special tools or programming shall be required to change operation modes. This application will utilize duplex pump down mode control based on 3 sensor inputs representing common pump stop, lead & Lag pump required, and high level alarm. In this mode, the 4th and 5th input shall be available for future use as a second pump stop (for independent pump stop operation) or low level alarm.
3. The Pump Controller shall allow easy operator selection of pump sequences via built in switch. Operator shall be able to operate pumps in a fixed pump sequence or alternating

sequences. The controller shall allow operator removal of pumps from operation for service or repair via built in switch adjustments.

4. The Pump Controller shall have user adjustable built in delay timers to prevent inadvertent starting and stopping of pumps and prevention of nuisance alarms based on momentary signal input(s). Time delay shall also protect motors from operating to quickly after a power failure and allow power to stabilize before allowing motors to start.
5. The Pump Controller shall have built in float input sequence failure logic. The presence of this alarm shall signify a possible float switch failure, tangling or wiring problem. Upon detection of this failure, the audible alarm output shall be activated.
6. The Pump Controller shall interface to motor starter pilot circuits and alarm circuitry via built in relay outputs. Each output shall have a minimum contact rating of 7 Amps @ 240 VAC ensuring reliable and long life operation of inductive loads such as motor starters and solenoids. All outputs shall be form A with the exception of the audible alarm output, this shall have a form C contact allowing fail safe configurations. The controller shall be able to accept an external alarm acknowledge signal that will inhibit (Silence) the audible alarm output. The audible alarm output shall be activated upon detection of high, low or (Float Switch) out of sequence alarm.
7. The Pump Controller shall be able to accept a discrete input for inhibiting the operation of the pumps. Upon activation of the input, the controller will disable only the pump required outputs and will flash the associated output activation LED to indicate external inhibit. Level alarms shall still activate alarm outputs. Upon release from the inhibit signal, the pumps that are required will be allowed to restart while enforcing the start delay.
8. The Pump Controller shall be supplied with local status indication, via long life LEDs, of float input status and control and alarm output status. LEDs shall be illuminated when the associated input or output is active. LEDs shall be located on the front of the controller so they are easily viewed.
9. The Pump Controller shall operate on 120 VAC power source, be UL 913 listed for intrinsically safe operation in Class I, Divisions 1 & 2, Groups A,B,C,D operation and be certified to CE 61000-4 standards for electro-static discharge, radio frequency, and fast transient immunity.
10. The back up float system shall latch in upon detection of a high level alarm and shall disable the primary controller. The back up system shall provide control for the pumps. A local front panel mounted indictor light shall indicate system in back up operation. A push button mounted on the front door shall be provided to reset the back up system to allow the primary control system to be reengaged.

L. Float Switch – Back Up Control:
   1. The Contractor shall furnish, install, and wire float switches for back up control as shown on the drawings. Floats shall be mounted using cable suspension kit with submersible level transducer.

M. Over-Temperature Pump Protection & Pump Seal Failure Alarm:
   1. For each pump, install, wire and test motor protection module provided by the pump supplier. The module monitors thermal imbedded detectors and/or leak detectors and provides a contact closure for each detector. The control shall provide pump operation lockout upon the occurrence of high temperature. A manual reset will be required to bring the pump back into operation. Seal failure shall not lock out the pump from operation.

2. The circuitry shall also include a 30.5 mm diameter, NEMA Type 4X, red “pump overtemp” shutdown alarm indicating light and a 30.5 mm diameter, NEMA Type 4X, manual reset push-button on the operator’s door for each pump motor.
3. An operator’s door mounted 30.5 mm diameter, NEMA Type 4X red seal fail alarm light shall be provided to indicate a pump seal failure alarm condition for each sewage pump.
4. Indicator lights shall be push to test type.

N. Terminal Blocks:
1. Terminals shall be provided for connection of the electric power supply wiring, pump circuit wiring and the liquid level regulator cabling. Provide each terminal with maker. Mark each wire with a permanent wire marker.

2.6 ACCESSORIES

A. Liquid Level Switch Sensors:
1. Float switch(s) shall be designed to insure long life and reliable operation in both water and wastewater applications. Float switch body shall be constructed of high impact, corrosion resistant, polypropylene housing measuring not less than 2.74” in diameter and 4.83” long. The float shall have a long life, high reliability, SPST (available as normally-open/blue cap or normally-closed/red cap) internal switching mechanism. The switching mechanism shall employ sealed gold cross-point contacts rated for 1 Amp at 30 VDC/125 VAC. A multi-stranded, two-conductor, 18 gauge, CPE jacketed cable SJOW (UL, CSA) cable shall be part of the assembly. The cable shall be made especially for heavy flexing service. The entire float switch assembly shall be suitable for use in liquids up to 140 degrees Fahrenheit/60 degrees Celsius.
2. The float switches shall be mounted to a common stainless steel direct suspension mounting bracket. The bracket shall provide mounting and strain relief connectors for up to four (4) float switches. Individual PVC-coated weights with a cast-in-place cable slot shall provide drift free mounting. The float switches and accessories shall be as manufactured by PRIMEX.

B. Submersible Level Transducer:
1. The transducer housing shall be fabricated of a Teflon™ coated 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, limp, foul-free, molded Teflon™ bonded to a synthetic rubber back/seal. System design shall allow maintenance free operation in both water and wastewater environments (high solids). Housing construction shall resist and be unaffected by the build up of solids on its surfaces or sensing diaphragm. The transducer electronics shall be encased within the protective housing and shall be electrically and mechanically isolated from the sensed media via non-conductive fluid filled pressure transference cavity and barometric compensated transducer electronics chamber. Metallic or ridged diaphragms shall not be acceptable in that they are subject to damage or distortion.
2. The submersible level transducer shall be a two-wire type and shall operate from a supply voltage of 9 to 30 VDC and produce a 4-20 mA signal in direct proportion to the measured level excursion over a pre-calibrated range of 0 to 5 PSI. The unit shall have ample instrument loop load capacity and shall be able to drive a minimum load of 750 Ohms @ 24 VDC loop power. The sensor technology shall be based on the use of a highly reliable and stable piezo-resistive pressure element with a .25% full scale accuracy with compensation for non-linearity, hysteresis and repeatability. The unit shall operate over a wide –40 to 185 Deg F. temperature range and shall have not more than a 3% full scale

error over a –4 to 180 Deg F. range. The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures 4X 5 PSI times the full-scale range being sensed. Sensing principles employing less reliable technologies including LVDTs, capacitance or pneumatic elements shall not be acceptable.

3. The internal pressure of the transducer assembly shall be relieved to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly with a dedicated breather tube. The tube shall be ridged to prevent compression that may result from mounting or folding of the cable through installation. The breather system shall be sealed through the use of a rugged maintenance free air bladder assembly connected to the breather tube and mounted within a junction box or monitoring panel. The sealed breather system shall compensate for variations in barometric pressure including expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive/atmospheric elements. Barometric compensation systems that are not closed or use desiccant air-drying devices requiring periodic maintenance shall not be accepted. Systems that do not use a dedicated breather tube, or can be rendered inoperative due to pinching or folding of the cable shall not be acceptable.
4. The transducer shall be installed where directed by the Engineer and connected with other system elements and placed in successful operation. It shall be provided with input power and output signal transient protection, associated control elements as specified herein and in accordance with manufacturer's instructions.
5. Submersible level transducer shall be the “Level Rat” as manufactured by Primex Controls.

PART 3 EXECUTION

3.1 GENERAL

A. Placement of the wet well and valve manhole structures shall be in accordance with National Precast Concrete Association’s “NPCA Manhole Installation Guide” and as shown in the plan except as modified herein.

3.2 EXCAVATION, TRENCHING & BEDDING

A. Excavate for manhole in accordance with Section 31 23 33: Trench Excavation and Backfilling for Utilities for the work of this section.

B. Granular bedding material and encasements are required as indicated in the plans.

C. In wet or unsuitable soil conditions, the Contractor shall excavate 6” below the bottom of the pipe, furnish and install a 6” crushed rock foundation to provide support for the manhole installation.

3.3 WET WELL AND VALVE MANHOLE STRUCTURES

A. The Contractor shall clean all construction debris, dirt and gravel out of the wet well prior to setting the pumps.

B. One wrap of the wires from the floats, pumps, and transducer shall be wrapped around the cable holder. All excess wires shall be wrapped and put in the vent skirt below the control panel.

C. Every joint on each structure manhole shall be sealed with a precast joint external seal wrap to prevent leakage into the structure.

D. The general location and configuration of the piping and fittings is shown on the Lift Station detail in the plans.

E. The contractor shall determine the exact location and layout of the piping to fit the specific equipment selected, and to meet other construction conditions, which shall be submitted to the Engineer for review in the form of detailed shop drawings.

3.4 PUMPS

A. The Contractor shall clean all construction debris, dirt and gravel out of the wet well prior to setting the pumps.

B. The Contractor shall coordinate the construction of the lift station and the selection of lift station piping, fittings, doors, etc. with the submersible pump selected.

C. The general location and configuration of the piping and fittings is shown on the Lift Station detail in the plans, but shall be coordinated with the pump selected.

D. The Contractor shall determine the exact location and layout of the piping to fit the specific equipment selected, and to meet other construction conditions, which shall be submitted to the Engineer for review in the form of detailed shop drawings.

3.5 CONTROLS

A. Installation:
   1. Install in accordance with manufacturer's instructions.
   2. Each conductor shall be tagged and numbered in accordance with the manufacturer's wiring diagram. All outgoing wires shall be connected to an outgoing terminal strip. All wires shall be fastened to electrical components by solderless mechanical connectors to facilitate replacement. All wiring shall be neatly tied and fastened to the chassis as required.
   3. Clean Control Panel interior and exterior.

B. Control Manufacturer Services:
   1. The services of a factory trained, qualified service representative of the equipment manufacturer shall be provided to inspect the complete equipment installation to insure that it is installed in accordance with the manufacturer's recommendations. Conduct the start-up of the lift station & control panel, make all adjustments necessary to place the system in a trouble-free operation and instruct the operation with the operating personnel in the proper care and operation of the equipment furnished.
   2. Six (6) type written copies of the operating instructions shall be provided through the Engineer.
   3. A minimum of one (1) 8-hour day for Owner training once the lift station has been started-up and operating correctly shall be provided, with an additional one day approximately six (6) months after start-up.

C. Field Installation:
   1. The services of a factory trained, qualified representative shall be provided to install the completed system, make all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment.

D. Guarentee:

1. All equipment shall be guaranteed against defects in material and workmanship for a period of one year from the date of Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

3.6 FIELD QUALITY CONTROL

A. Section 00 14 00: Quality Requirements: Field inspecting and testing.

B. Upon completion of the testing and jetting of the sanitary sewer main, all wet well structures and valve manholes shall be cleaned prior to final acceptance and system startup.

C. Submersible Centrifugal Pumps Start-Up
   1. The Contractor or a Manufacturer representative shall subject each pump to a 24-hour operation test before acceptance. The unit shall be properly installed in the wet well, firmly upon its discharge connection after determination: (a) Proper service voltage is being supplied, and (b) Proper rotation of impeller. No cooling by forced or circulated air shall be allowed.
   2. Equipment manufacturer shall supply the services of a qualified field service representative to check out, start-up, and certify in writing to the Owner that equipment and installation meets the requirements of these specifications and manufacturer requirements. Certification shall be furnished for each pump. Field service representative shall furnish a written report detailing all findings, including all deficiencies along with corrective action taken.
   3. As part of the system startup, the service representative shall, with the assistance of the Contractor, conduct draw down testing. Water shall be available for filling the wetwell multiple times. The pumps shall be operated until flow is observed at the forcemain discharge. At that point, the drawdown testing shall be performed. With the pumps off, the wetwell shall be filled at or above the high alarm level and the liquid level measured. The pumps shall be put into operation and the draw down time to shutoff recorded. Conduct the drawdown test a total of three times, not including filling forcemain. The results shall be recorded and reported to Owner representatives in written format. If desired pumping capacities are achieved, drawdown testing will be deemed complete. If desired pumping capacities are not met, further investigation and additional testing will be required and corrective measures taken at no expense to the Owner. Owner is to be present for the drawdown testing and shall be given 48 hours' notice prior to the testing.
   4. Equipment manufacturer shall also supply the services of a qualified service representative for one (1) trip on site to instruct Owner's personnel in proper operation and maintenance of equipment. Time of trip shall be at the request of the Owner. Minimum instruction time shall be 8 hours.

D. Any portion of the work deemed to be defective through the testing shall be remedied at no additional cost to the Owner.

E. Owner or Engineer shall be present for all testing for verification of results.

F. The Owner will not consider final acceptance or substantial completion until all testing, cleaning, and corrective action is completed to the satisfaction of the Engineer.

3.7 PROTECTION OF FINISHED WORK

A. Section 00 17 00: Execution Requirements: Requirements for protecting finished Work.

B. Protect structure and aggregate cover from damage or displacement until backfilling operation is in progress.

C. Protect pumps, piping, valves and control panel from damage or displacement during construction operations.

END OF SECTION

SECTION 33 42 00 - STORMWATER CONVEYANCE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. PVC pipe sewer.
   2. HDPE pipe sewer.
   3. Nyloplast Drain Basin.
   4. Concrete Manholes and Catch Basins.

B. Related Sections
   1. Section 31 23 33: Trench Excavation and Backfilling for Utilities
   2. Section 31 25 00: Erosion and Sediment Controls

1.2 SUBMITTALS

A. Product Data:
   1. Submit data on pipe, fittings and accessories.
   2. Submit shop drawings of the storm sewer structures to the Engineer for review prior to fabrication.

B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents:
   1. Accurately record actual locations of pipe runs, connections, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials shall be in accordance with MnDOT Standard Specifications for Construction, Latest Edition, Section 2501, Section 2502, Section 2503, Section 2506, Section 2511, and the most current MnDOT special provisions.

2.2 PVC STORM SEWER PIPE

A. All PVC pipe and fittings shall be manufactured and constructed in accordance with the State Plumbing Code and any local jurisdiction requirements.

2.3 HIGH DENSITY POLYETHYLENE PIPE

A. All HDPE pipe and fittings shall be manufactured and constructed in accordance with the State Plumbing Code and any local jurisdiction requirements.

B. If HDPE pipe is shown as perforated on the plans or details, it shall have a geotextile wrap/sock.

C. End section joints shall be tied and provided with approved trash guard.

2.4 CONCRETE MANHOLES AND CATCH BASINS

A. Shall be pre-cast concrete meeting the requirements of ASTM Specification C-478 and MnDOT Standard Specifications for Construction, Latest Edition, Section 2506, and the most current MnDOT special provisions.

B. Manholes and catch basins shall conform to MnDOT Standard Plate 4003, 4005, or 4006 as applicable by the design designated on the plans.

C. All joints shall be gasketed.

2.5 AREA DRAIN BASINS

A. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc. or engineer approved equal.

B. PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer.

C. Drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermoforming process to reform the pipe stock to the specified configuration.

D. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin.

E. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.

F. The grates and frames furnished for all area drain inlets shall be ductile iron for sizes 8” – 30” and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the area drain inlet. Grates for drain basins shall be capable of supporting various wheel loads as specified by Nyloplast. Ductile iron used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05. Grates and covers shall be painted black.

PART 3 EXECUTION

3.1 GENERAL

A. Execution shall be as specified in the State Plumbing Code and MnDOT Standard Specifications for Construction, Latest Edition, Section 2501, Section 2502, Section 2503, Section 2506, Section 2511, and the most current MnDOT special provisions.

3.2 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify existing utility sewer main size, location, and inverts are as indicated on Drawings.

3.3 EXCAVATION, TRENCHING & BEDDING

A. Excavate pipe trench in accordance with Section 31 23 33: Trenching Excavation and Backfilling for Utilities for the work of this section.

B. Granular bedding material and encasements are required as indicated in the plans.

C. In wet or unsuitable soil conditions, the Contractor shall excavate 6” below the bottom of the pipe, furnish and install a 6” crushed rock foundation to provide support for the pipe installation. Foundation rock will be incidental to pipe installation price.

D. The Contractor shall not impede existing drainage ways during construction, if necessary, the Contractor shall temporarily bypass until permanent measures are operational.

3.4 PREPARATION

A. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.5 PIPE SEWERS AND CULVERTS

A. All culverts or pipe sewers to be removed or salvaged and reinstalled shall be replaced at the same location and elevation unless otherwise shown on the plans.

B. All existing pipe sewers or culverts are to remain in place if possible unless otherwise shown on the plans.

3.6 AREA DRAIN BASINS

A. The specified area drain basins shall be installed using conventional flexible pipe backfill materials and procedures.

B. The backfill material shall be crushed stone or other granular material meeting the requirements of class 1, class 2 or class 3 material as defined in ASTMD2321.

C. Bedding and backfill for area drains shall be well placed and compacted uniformly in accordance with ASTM D2321.

D. The area drain body will be cut at the time of the final grade. No brick, stone or concrete block shall be used to set the grate to final elevation.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 46 11 - STORMWATER MANAGEMENT SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections
   1. Section 31 05 16: Aggregates for Earthwork
   2. Section 31 22 00: Grading
   3. Section 31 23 33: Trench Excavation and Backfilling for Utilities
   4. Section 31 25 00: Erosion and Sediment Controls

1.2 SUBMITTALS

A. Submit data on pond mixes including sand, and amendments.

B. Submit shop drawings of the storm sewer structures to the Engineer for review prior to fabrication.

C. Submit special procedures required to install Products specified.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents:
   1. Accurately record actual locations of pipe runs, connections, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.1 GENERAL

A. Stormwater Management System shall be comparable to what is detailed in the plans and be able to achieve the stormwater management characteristics identified in the Stormwater Management Study included as part of these specifications.

B. HydroCAD information will be provided by the Engineer to the Contractor prior to shop drawings as the Contractor is required to provide modeling showing that any alternate systems meet the required stormwater parameters outlined in the Stormwater Management Study.

PART 3 EXECUTION

3.1 GENERAL

A. Infiltration areas are shown on the Plans.

B. Areas that will be used for temporary erosion control basins shall be established early in the project.

C. Temporary erosion control basin areas that will be used as final stormwater best management practices shall be protected as outlined in the Stormwater Pollution Prevention Plan (SWPPP).

3.2 INFILTRATION SYSTEMS

A. Infiltration System areas are shown on the plans.

B. Infiltration system shall be protected during construction as outlined in the Stormwater Pollution Prevention Plan (SWPPP).

C. Excavate to subgrade elevation after entire site is stabilized unless otherwise authorized by Owner or Owner's representative.

D. Once subgrade elevation is reached the top 12" shall be ripped.

E. System shall be compacted with low impact equipment to a density not exceeding 90% dry density using the standard proctor test.

3.3 QUALITY ASSURANCE

A. Infiltration rate shall be determined by a double ring infiltrometer test for the stormwater management system upon excavation to subgrade and prior to installation of the system. Contractor shall coordinate with Geotechnical Engineer to perform the test.

B. Variances between the field Infiltrometer Test and the infiltration rate listed in the Stormwater Management Study for the project to be discussed with the Engineer to determine if modifications to the system, outlet structure, grading or other improvements is needed.

C. If the Infiltrometer Test exceeds the maximum infiltration rate of 8.3 inch/hour, the Contractor shall amend the soils in the basin to reduce the infiltration rate to meet MPCA guidelines.

END OF SECTION